ARCHITECTURE DEPARTMENT

MASTER OF ARCHITECTURE PROGRAMME

CHINESE UNIVERSITY OF HONG KONG

2006-2007 DESIGN REPORT

WEAVING DIALOGUE WITH THE ROCK

NG Pui Tsz, Peggy May 2007

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Design Report

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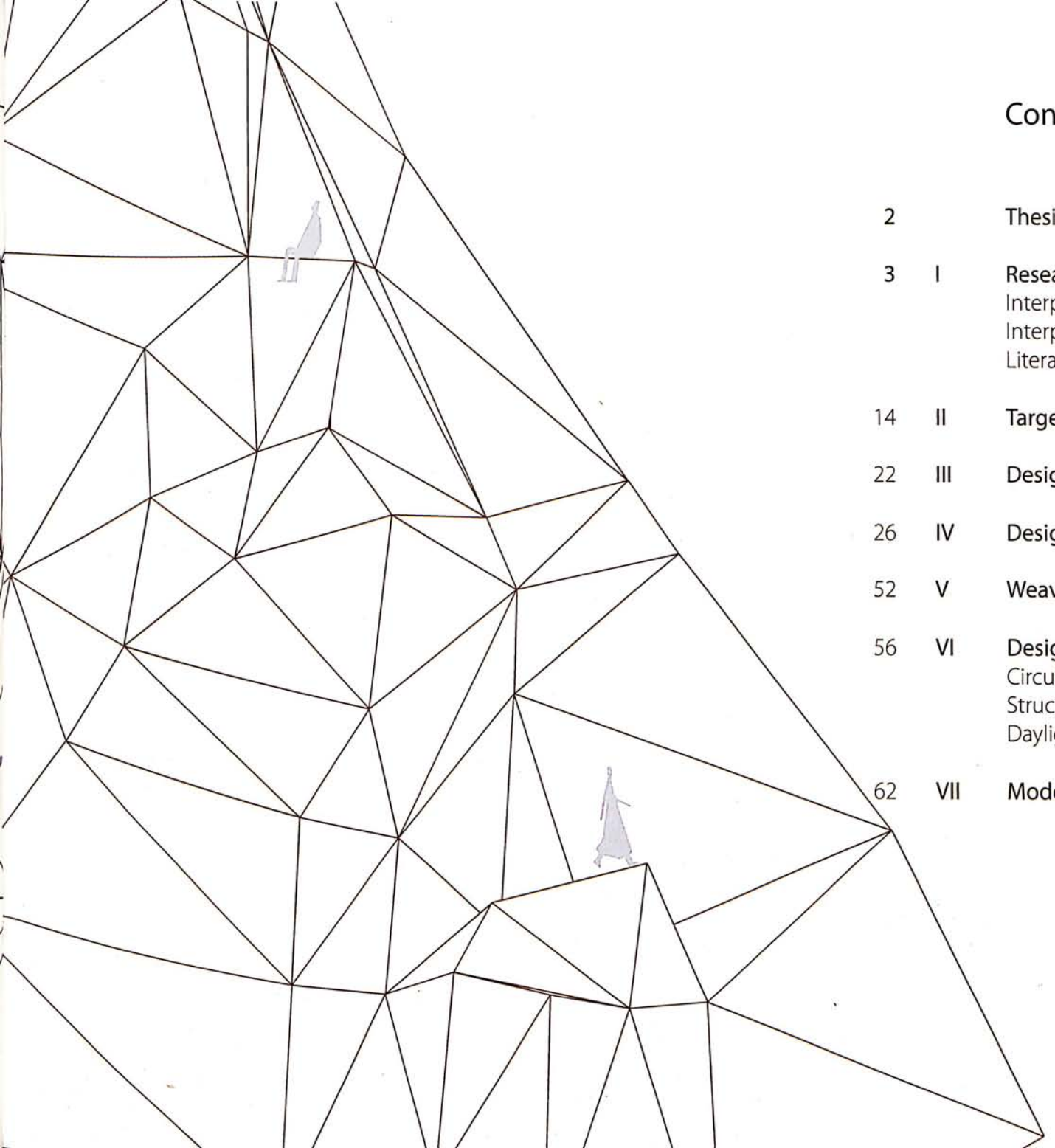


Content

Being excavated, abandoned and forgotten, the rock face of quarry becomes a fusion of natural landscape and artificial vestige. Could the rock face and even the quarry be reconstructed and revitalized? This thesis is exploring potential solutions between the natural and the artificial, by way of an architecture that adopts the geography of the place and transforms it, in an on-going dialogue.

被開採、被廢棄、被遺忘，促成了石礦場裡石面型態上的自然與人工的共生。石面、甚或至石礦場本身能否再造、再生？本論文正要討論如何透過從建築上對石面形態的融合和轉化，建立起石礦場裡自然與人工的融和與對話。而石面的組織、形態以及質感將有助於在不同的尺度上構想設計。

Research Intention:

Nature of Quarry Faces

Nature is scared VS Intriguing texture

Quarry face is a scar on the city surface
Quarry face reveals the understructure

This dilemma arises my interest on researching the quarry faces.

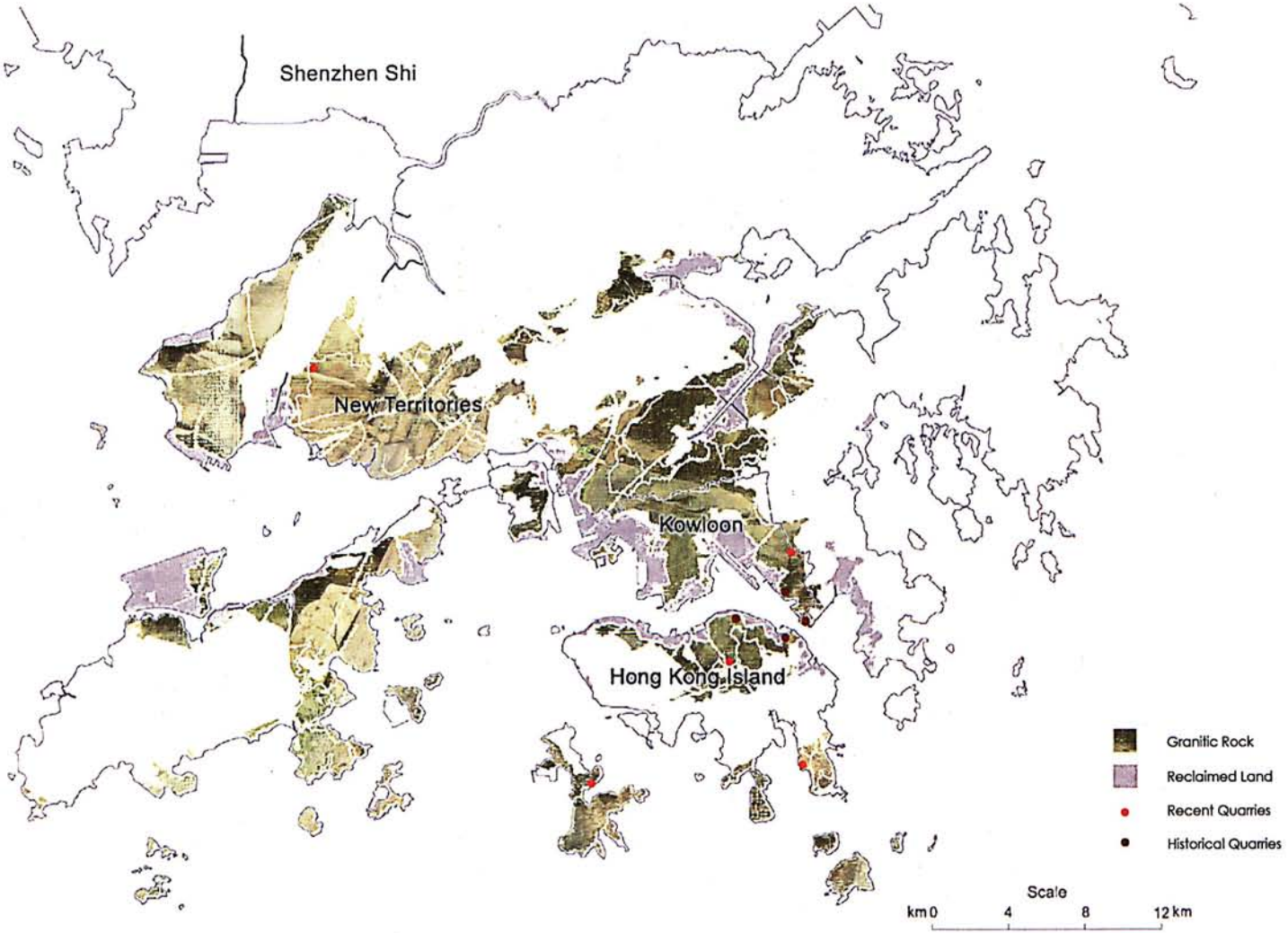
Interpretation of Quarry

Supplying a heavy demand for concrete aggregates, quarry operations in Hong Kong created high and near vertical quarry faces. It is very prominent when viewed across the harbor. The natures of quarry face are various. Most people have negative feeling towards it. Quarry face becomes a scar on the city surface. On the other hand, quarry face reveals the understructure. Nature is scared versus intriguing texture. This dilemma arise my interest on researching the quarry face.

As my architectural approach is to build a building against the quarry face, how to design a rock building against the rock face becomes my challenge. Rock is the key element of quarry. It induces the exploitation of quarry and is the only product of this activity. Even after the extraction, numerous rocks are abandoned and left on the quarry site.

So, I would like to use rock as my key design element. Weaving means to compose a connected whole by combing various elements or details. The different perspectives of quarry face are weaved together in this project. Thus, weaving the rock is emphasized. The appearance of quarry face mainly depends on two factors. First is the quarrying activity. That is how the stone is cut and extracted from the hill. Second is the natural formation of rock. That is how the rock is bonded together. The research is going to interpret these two subjects: quarry and rock.

For the interpretation of quarry, the study starts from the history and statistic of quarrying activities in Hong Kong. After the site visits to some present and dismissed quarries, different forms of quarry faces are found. The traditional high and near vertical quarry face is replaced by benching form in modern quarry. Literature research is then carried out to investigate the changes of quarrying methods throughout the century. There were two seminars about the quarrying industry in Hong Kong by the institute of quarrying in the early 1990s. Based on the findings, the difference between traditional and modern quarries is not only due to the improved technology by industrialization, the consideration of restoration also take part in the explanation.



Distribution of Granitic Rock and Quarries

Quarry sites are located at area where Granitic rocks underlie. In the early period, quarries were mainly found at the sea shore such as Lei Yue Mun, Cha Kwo Ling, Quarry Bay and Shau Kei Wan. It is due to the delivery of rock pieces by shipping. Nowadays, only three large-scale quarry sites are operating. They are located at Anderson Road, Shek O and Lam Tei.

Quarry Development in Hong Kong

Prior to the early 1960s, the quarrying industry in Hong Kong was largely in the hands of small quarry operations who extracted stone at sites under the authority of a permit. These permit quarries were small, labour intensive, and produced only a few hundred tones of aggregates in a day. Quarrying started at bottom floor level. Rock was drilled, and explosives placed, by hand by men hanging from ropes on the quarry face. Hand-held jack hammers were used to loosen unblasted rock from the face. Rock was subsequently broken down manually until it was small enough to be fed into small secondary crushers. The face was advanced upwards with final faces reaching heights of up to 100m.

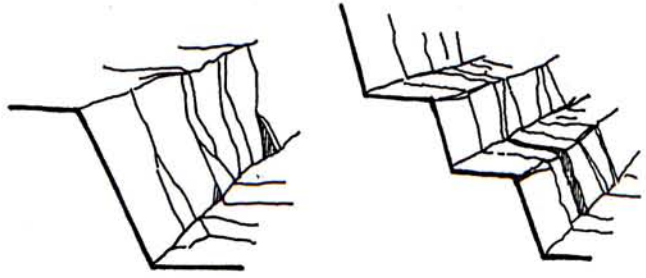
A new type of quarry, which was held on Government contract after competitive tendering, began to emerge. In 1968, Government decided that no more quarries should be allowed on permit since the permit quarries were generally unsatisfactory. The modern contract quarries began to use the benching method of quarrying and were worked systematically in levels from the top down. Modern quarrying operations are more mechanized. The height of any face in a quarry is not to exceed 24.5m unless approved by the Authority.

Top left: The vertical face of a permit quarry

Top right: The face and bench of a modern quarry

Bottom: Comparison of rock faces between old permit quarry (left) and modern quarry (right)

[The Hong Kong quarrying industry 1990-2000, Hong Kong: The Institute of Quarrying - Hong Kong Branch, 1990]





Historically, stone-cutting was one of the major industries in Hong Kong. The date when the quarry work began operating is unknown, although in 1844, the Hong Kong Government reported that "Stonecutters have been working here for many years before our arrival". The abandoned quarry sites in Lei Yue Mun (and Cha Kwo Ling) are possibly the only physical remains which provide evidence of this activity. In the quarrying industry of Hong Kong, traditional permit quarries were gradually replaced by modern contract quarries in 1970s.

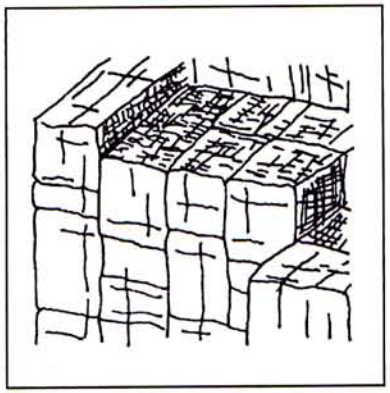
Prior to the early 1960s, the quarrying industry in Hong Kong was largely in the hands of small quarry operations who extracted stone at sites under the authority of a permit. These permit quarries were small, labour intensive, and produced only a few hundred tones of aggregates in a day. Quarrying started at bottom floor level. Rock was drilled, and explosives placed, by hand by men hanging from ropes on the quarry face. Hand-held jack hammers were used to loosen unblasted rock from the face. Rock was subsequently broken down manually until it was small enough to be fed into small secondary crushers. The face was advanced upwards with final faces reaching heights of up to 100m.

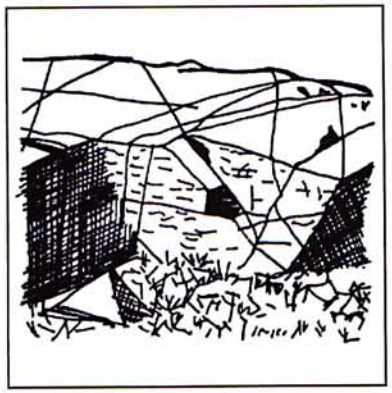
These traditional quarries created a vertical rock wall in the city. Vegetation was difficult to grow on this steep surface. However, due to natural weathering on the rock face, patterns and markings appeared to decorate this city's backdrop. The appearance of quarry face becomes closer to the natural cliff. The texture of face also reflected the historical process by stone workers. So, this quarry face is a kind of cultural heritage that should be retained. Unfortunately, similar historical quarry face in Sau Kei Wan is proposed to be removed and built a power sub station although communal groups do show their opposition.

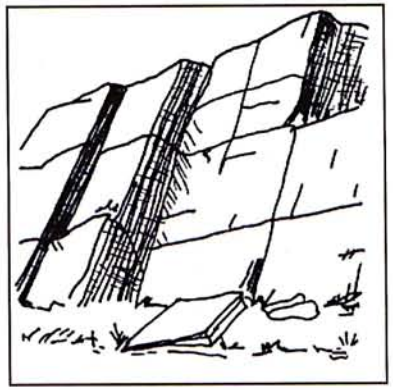
A new type of quarry, which was held on Government contract after competitive tendering, began to emerge. In 1968, Government decided that no more quarries should be allowed on permit since the permit quarries were generally unsatisfactory. The modern contract quarries began to use the benching method of quarrying and were worked systematically in levels from the top down. The height of any face in a quarry is not to exceed 24.5m. Modern quarrying operations are more mechanized. There is an increase of size of the equipment for drilling, blasting, loading and hauling.

The new benching landform not only provides working and delivery space for quarrying, the benches also allow the vegetation establishment which is common in modern quarry restoration. However, this benching form of quarry face is much unlike the natural cliff; thus, more people think that quarry face is a scar in the city surface. In order to create a more natural appearance, irregularities could be introduced to the benches.

Interpretation of Rock

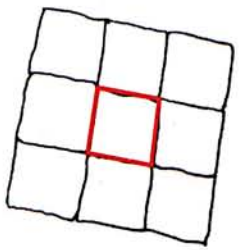




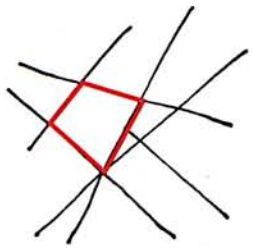


The appearance of stone masses depends on the numbers of joint sets. Up to three or four joint sets of stone may occur along different axes. The number of sets and orientation determine the shape of the resulting block.

Blocky



Irregular



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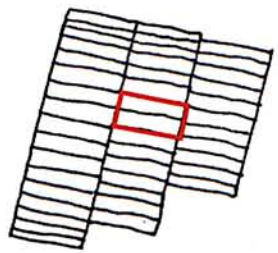
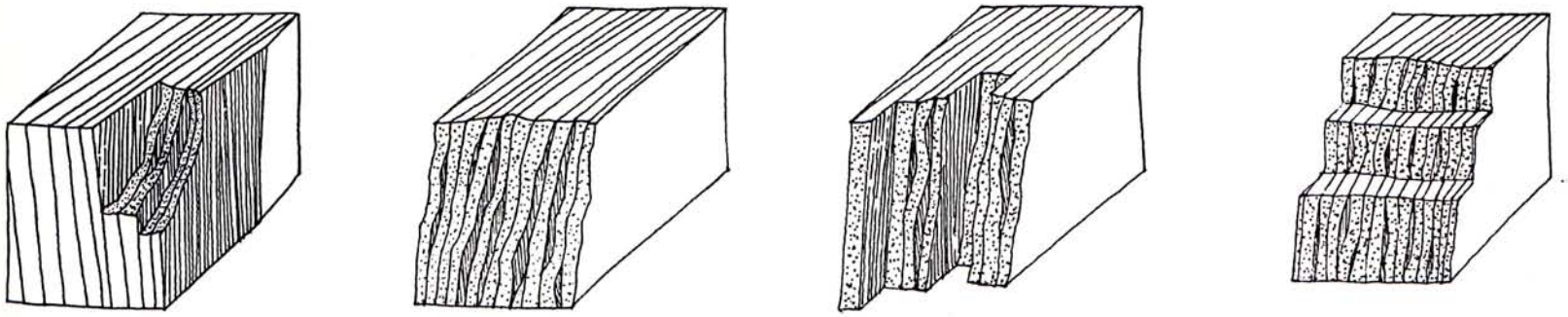


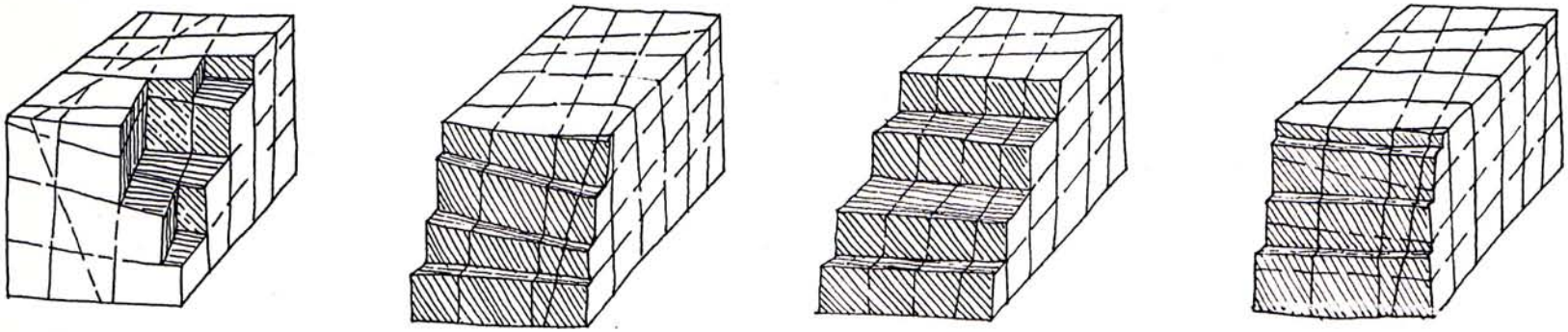
Columnar



one joint set

cutting follows joint set

close to nature



three joint sets

Literature Study of Rock

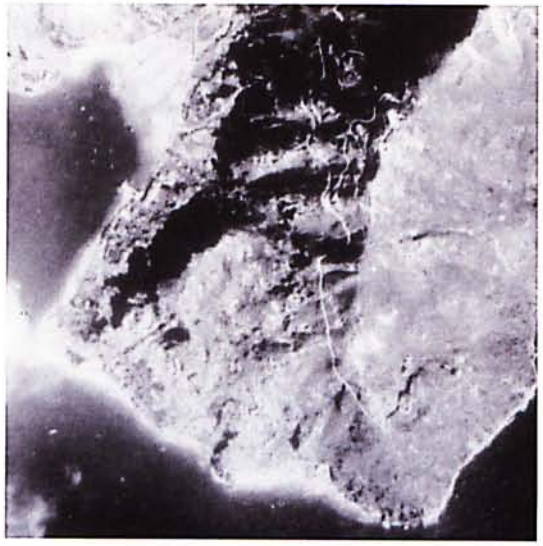
Besides the physical research of rock, literature review is also needed because it shows the attitude of people towards rock. I am interested in the below etching done by an Italian architect Giovanni Piranesi in the 18th century. In his fantastic imaginary perspective, pieces of irregular stones formed terraces of building on the mountain. The joints between stones were perfectly matched. Distinguishing the natural rock formations and the architecture seem impossible.

Out of my imagination, this kind of rock city really appeared in an ancient city called Matera in Italy. It was a steep city, perhaps the steepest on earth that it had challenged the laws of architecture and urbanism. Caves are carved out one above the other and arranged in a seemingly chaotic way. The roof of one house may appear as a road, a stairway, a garden or as the foundation of another house.

This precedent shows possibility of building at steep rock formation. Although the steep rock face acts as a constraint, it also provides potential for new type of building especially with innovative spatial orientation and circulation. Rock is being excavated from ground and put back in new way through architectural means.

Target Site - Lei Yue Mun Point

Historical map of LYM in 1904



Aerial photo of LYM in 1945

Aerial photo of LYM in 1963

Evolution of Lei Yue Mun quarries

History of Lei Yue Mun

1500 — The name "Lei Yue Mun" was first found in "Yue da ji" 粵大記 map in 16th century.

1700 — The pirate Cheung Lin-cheong built the Tin Hau Temple as a religious place for the village

1800 — In Daoguang period, Lei Yue Mun, Cha Kwo Ling, Sai Tso Wan and Ngau Tau Kok were called "Four Mountains".

1900

1911 — Concrete was introduced to construction industry.

1937 — British army built a pier in Lei Yue Mun near Ha Wan.

1938 — Sino-Japanese War caused the immigration of Chinese refugees. The population increased to 1000.

1941 — Japanese occupied Kowloon. Villagers went back to the mainland and population dropped sharply to 50.

1949 — The retreated Kuomintang soldiers of Chinese Civil War built Ling Nam San Village at north of Lei Yue Mun. Population rose to 1500.

1954 — Government organized the street names and house numbers. The population rose to ten thousands.

1957 — Lei Yue Mun Kai Fong Association was established.

1960 — The refugees from mainland crowded into Lei Yue Mun and population rose up to 15000.

1966 — Yau Tong Estate was completed. More fish sellers sold seafood on the boats. Tsau Wan was reclaimed as Typhoon shelter.

1969 — Prohibitive use of explosive during the 1967 riots.

1979 — 400 wooden huts were destroyed in the fire. Government started to retrieve the land.

1980 — Seafood business was prosperous.

1986 — Tin Hau Temple was renovated.

1997 — Ling Nam San Village was demolished.

2000 — Lei Yue Mun Municipal Services Building was completed.

The Devil's Peak was the site of a powerful gang of pirates.

Early History

Lei Yue Mun's location at the south-eastern corner of the Kowloon Peninsula provides a strategic location on the Lei Yue Mun Gap, the gateway to the east of Hong Kong Harbour as well as the narrowest gap, of water between Hong Kong Island and the Kowloon Peninsula. Historically, the area had been of military significance since the Ching Dynasty in the 17th century.

The earliest recorded settlement at Lei Yue Mun dates back to 1644 when a Ming Dynasty patriot, Li Wan-jung retreated to the Lei Yue Mun area and led a last-ditch attempt to resist the invasion of the Manchu. After he was finally defeated by the Ching soldiers in 1656, patriots such as Cheng Kung continued to fight against the Ching Dynsty at sea. Cheng Kin, a relative of Cheng Kung, led a number of Cheng Kung's followers and made Hong Kong their base. By 1678, Cheng Kin had established a powerful gang of pirates and controlled Lei Yue Mun Gap.

Cheng Kin's descendent, Cheng Lin-cheong, held the hills behind Lei Yue Mun in 1723. The place was originally called Carp's Peak, but Cheng Lin-cheong and his followers were so fierce that the villagers renamed the hills Devil's Peak.

British Colonial Period

Shortly after the New Territories was leased to Britain in 1898, the British military decided to reinforce the defence installations on both the northern and southern sides of Lei Yue Mun Gap.

On the northern side, two batteries with four gun emplacements were constructed on Devil's Peak, and a fort with barracks was also erected at the top of the peak in 1914. As a consequence, Devil's Peak is also known as Pau Toi Shan (Fortress Peak). The military installations on the southern side of Lei Yue Mun Gap (on Hong Kong Island) were also strengthened from 1887 to 1903 with between five to seven batteries with gun emplacements.

Lei Yue Mun fortification has a colourful military history. During the Second War, Lei Yue Mun was used as one of the Japanese landing points. The batteries and redoubt on Devil's Peak were captured by the Japanese after the British Forces retreated to Hong Kong Harbour, Devil's Peak was utilized by the Japanese as an artillery position to target military installations across the Gap.

Second World War

During the Japanese invasion in 1941, the fort on Devil's Peak was commanded by Brigadier Wallis and was guarded by Indian troop (the 5/7 Rajputs). When the Japanese army advanced to Devil's Peak, Wallis and the 5/7 Rajputs were ordered to evacuate the fort and withdraw to Hong Kong Island. Wallis recognizes the strategic location of Devil's Peak and refused to retreat. His decision was, however, overruled by Major-General Maltby, feeling that reinforcements for the defence of Hong Kong Island were more important that keeping Devil's Peak. Shortly after the evacuation, the Second Battalion of the Japanese Left Flank Group occupied Devil's Peak and utilized it as an artillery position to bombard Hong Kong Island. The military installations on both sides of Lei Yue Mun Gap were damaged during the Japanese invasion but ruins can still be seen today.

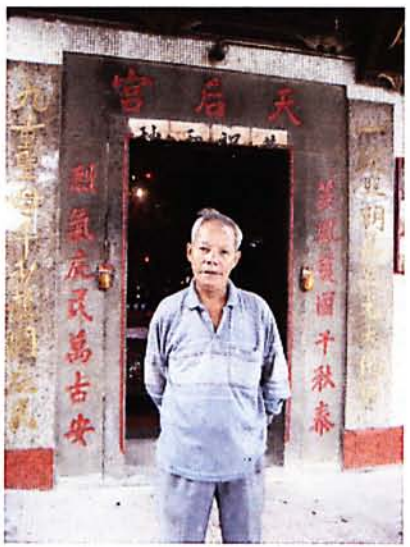
Post War Period

The original inhabitants of the villages at Lei Yue Mun were descendants of pirates and their followers, principally emigrants from mainland China in the Ching Dynasty. Traditionally, the villagers earned their living by fishing and farming. For the 1940s to the 1960s, a number of quarries in the south-eastern area of Lei Yue Mun were in full operation, employing not only the villagers, but also many mainland China emigrants arriving in Hong Kong during their period. A past quarry owner has stated that due to the prohibitive use of explosive during the 1967 riots, the quarries were closed down and the quarry business in Lei Yue Mun subsequently started to decline. Several buildings associated with the former quarry still remain to this day. A pier adjacent to the quarries was used to ship stones from Lei Yue Mun to other parties of Hong Kong and mainland China. It has long been abandoned and is now the only remaining section and a popular site for fishing.

After the closure of the quarries, villagers started up seafood business in Lei Yue Mun. Seafood market stalls and restaurants have been set up along the footpath along the waterfront. Visitors can buy fresh seafood from the market stalls and take them to the restaurants, and the restaurants will "tailor-made" banquets for them. Since the 1970s, Lei Yue Mun has become a famous tourist area and the seafood business has thrived.

Although Lei Yue Mun is a small village, it tried its best to sustain after the closure of the quarries. The economic activities have been transformed from industrial to tourist. However, seems most of Hong Kong people and even the villagers have forgotten its original identity – quarry village. Thus, by introducing architecture to this quarry face, more villagers and tourist can recognize its importance as a monument. Through this project, Lei Yue Mun can reconstruct its identity and rediscover its forgotten history.

Interview with residents



Mr. Chan

Mr. Chan is the temple keeper in Lei Yue Mun Tin Hau Temple. He has worked there for over 20 years. He was born in Lei Yue Mun and was a stone worker in young age. His parents also worked in the quarry. Initially, people extracted the rock by hands. The extracted rocks were used as beams for construction. The rocks were used by Hong Kong local buildings like Supreme Court, which is today's Legco building. Bricks were not common in the past. At a later stage, extracting machine was introduced to speed up the process of quarrying. There were several quarries in Lei Yue Mun operated by different companies in the past. Each had a pier to deliver the extracted rocks by ship. However, many piers collapsed and damaged. There was one pier in front of the Tin Hau Temple which collapsed several years ago. Those quarries gradually closed in 1950s.

There was a long beach along the seashore. The fishing community began when fishmen used the beach in Lei Yue Mun to dry the fish and sold the fish here. The seafood restaurants only began in 1960s. The Tin Hau Temple has been there for 200 years. The worshipers are mainly the outsiders. The temple would be crowded during Tin Hau Festival. Lei Yue Mun is a Hakka village. The Hakka people kept pigs and grew vegetable. The Sum Ka village (Three families' village) included Chan clans, Ip clans and Lau clans.

Mr. Liu

Mrs. Liu has lived in Lei Yue Mun for 8 years. She is an immigrant from the mainland and her husband is a local resident. She has retired after the SARS period. She lives at the seashore in Lei Yue Mun Point. Her husband bought a stone built house many years ago. That house used to be an office of the old quarry.

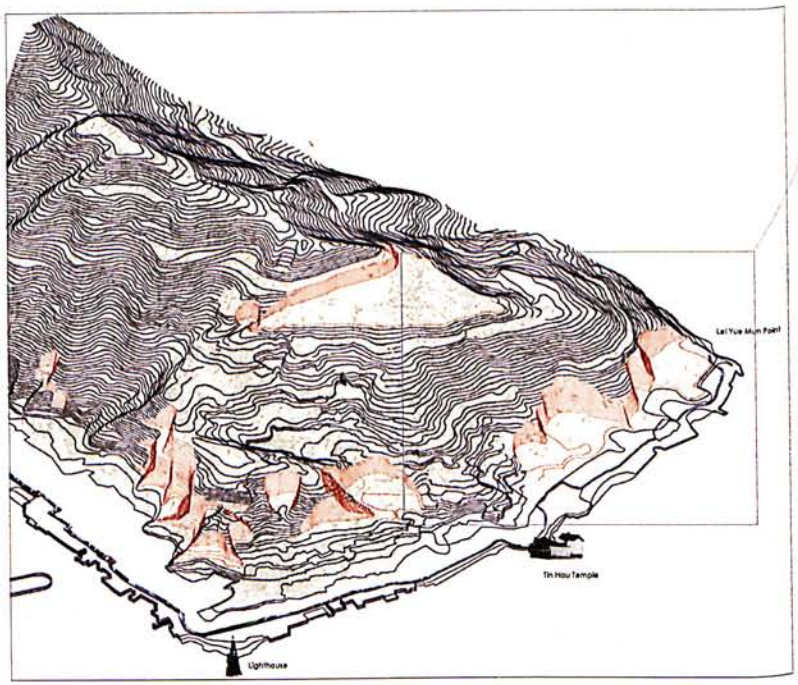
Her house is built on a 3m-high stone foundation. The size is about 2m by 2 m. Mrs. Liu prepares her meals at the ground level. Bottle of kerosene is used as fuel for cooking. The only problem of the house is rain linkage during bad weather.

She loves to live in Lei Yue Mun because the good air quality and her husband likes to go fishing near the Tin Hau Temple. There is a small lot of land for her to plant some banana trees and vegetables. She always walks along the seashore for relaxation. Mrs. Liu welcomes the tourists to visit Lei Yue Mun. She prefers lively environment and likes to talk with people.

Similar stone buildings like Mrs. Liu's one can be found near Lei Yue Mun Point. This indicates that there are several large quarries over there and these houses were used as office or residence for the quarry workers. As these stone houses were very tiny, most of them are being abandoned and become ruins. Since each of them have its own character, it is valuable that to make use of these ruins to demonstrate the previous lives of the quarry workers. Hong Kong is less of this kind of living museum.

Design Methodology

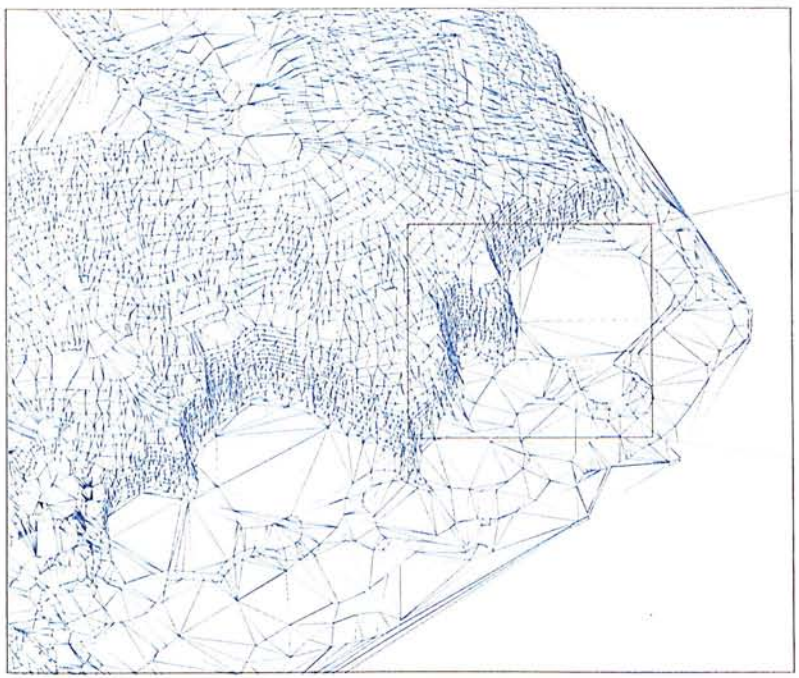
Aerial View of Lei Yue Mun



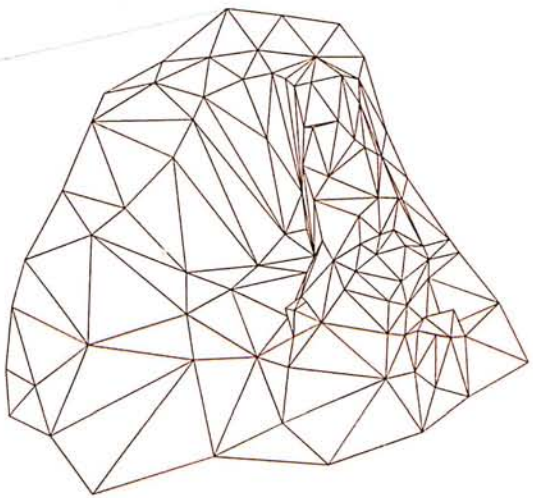
Quarry Distribution in Lei Yue Mun

Rock of quarry always gives people impression of mass. Re-interpretation of the site, which is applying a progressive deformation strategy to translate the organic and complicated form of the rock face to a simple triangular geometry, is adopted to generate the design.

My architectural respond allow the users to experience, understand and enjoy the rock surface quality of this disused quarry.

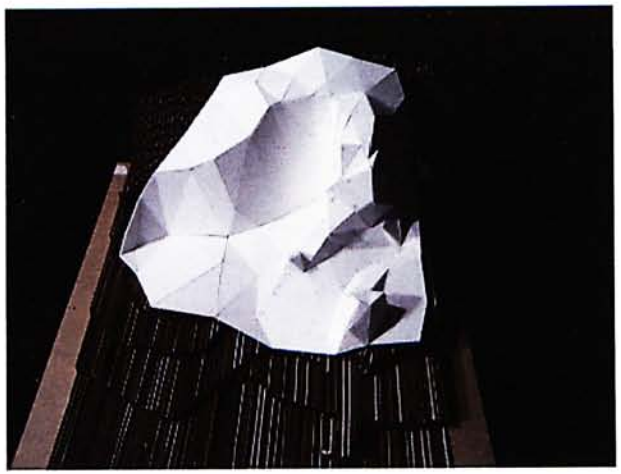


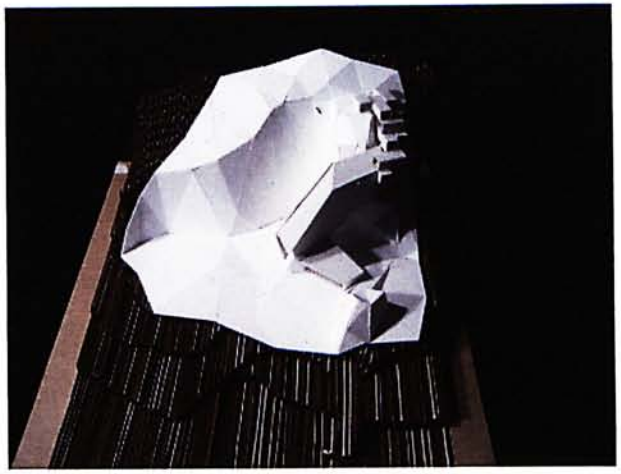
Unique Topography of Quarry Site

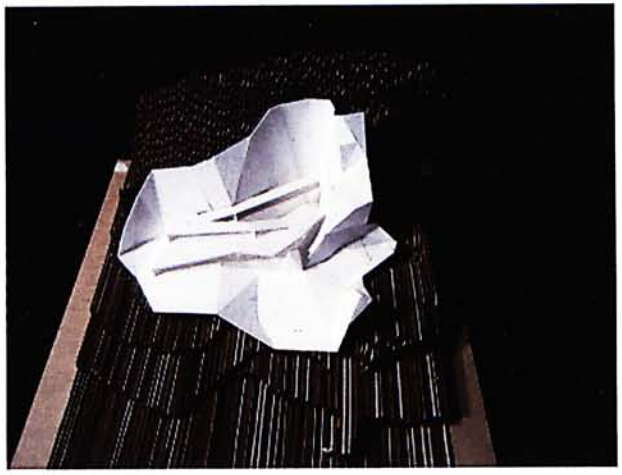


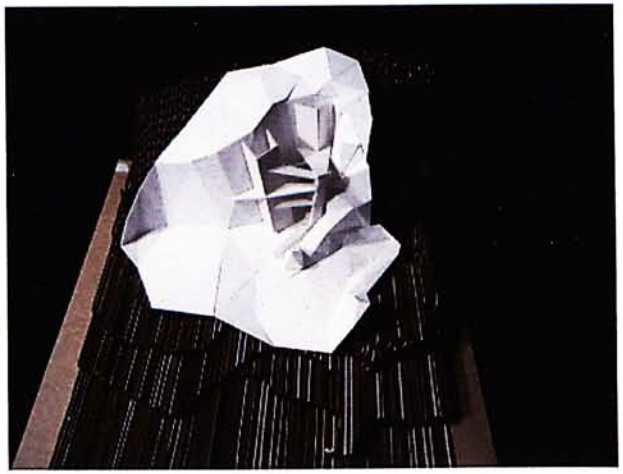
Interpretation of Quarry Face

Design Proposals

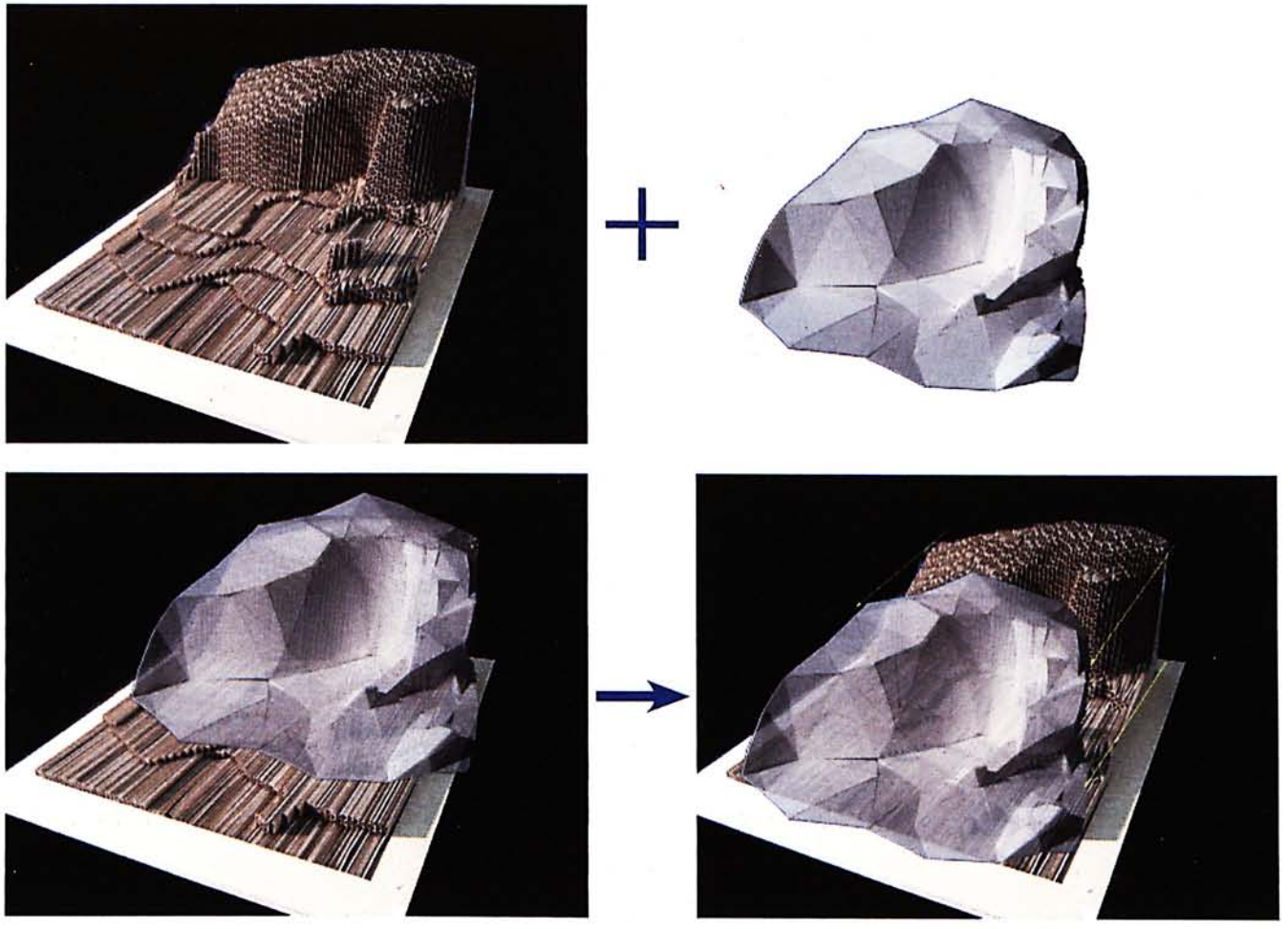




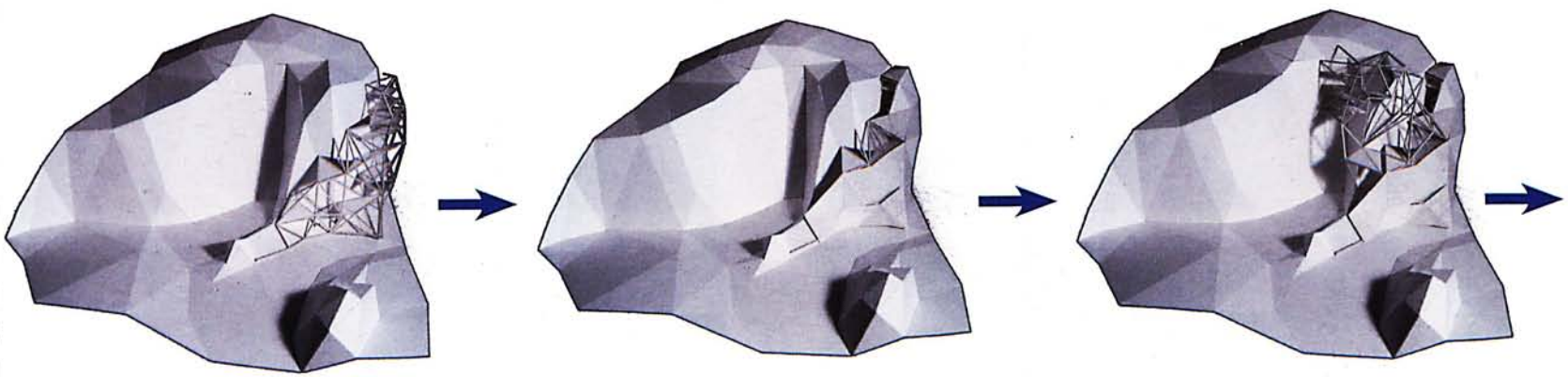


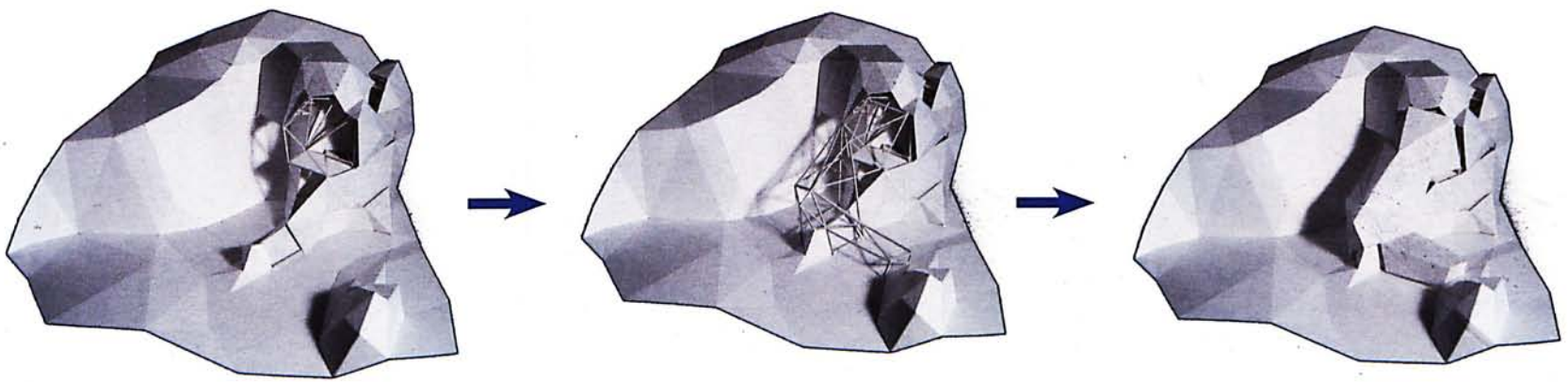


Final Design Proposal

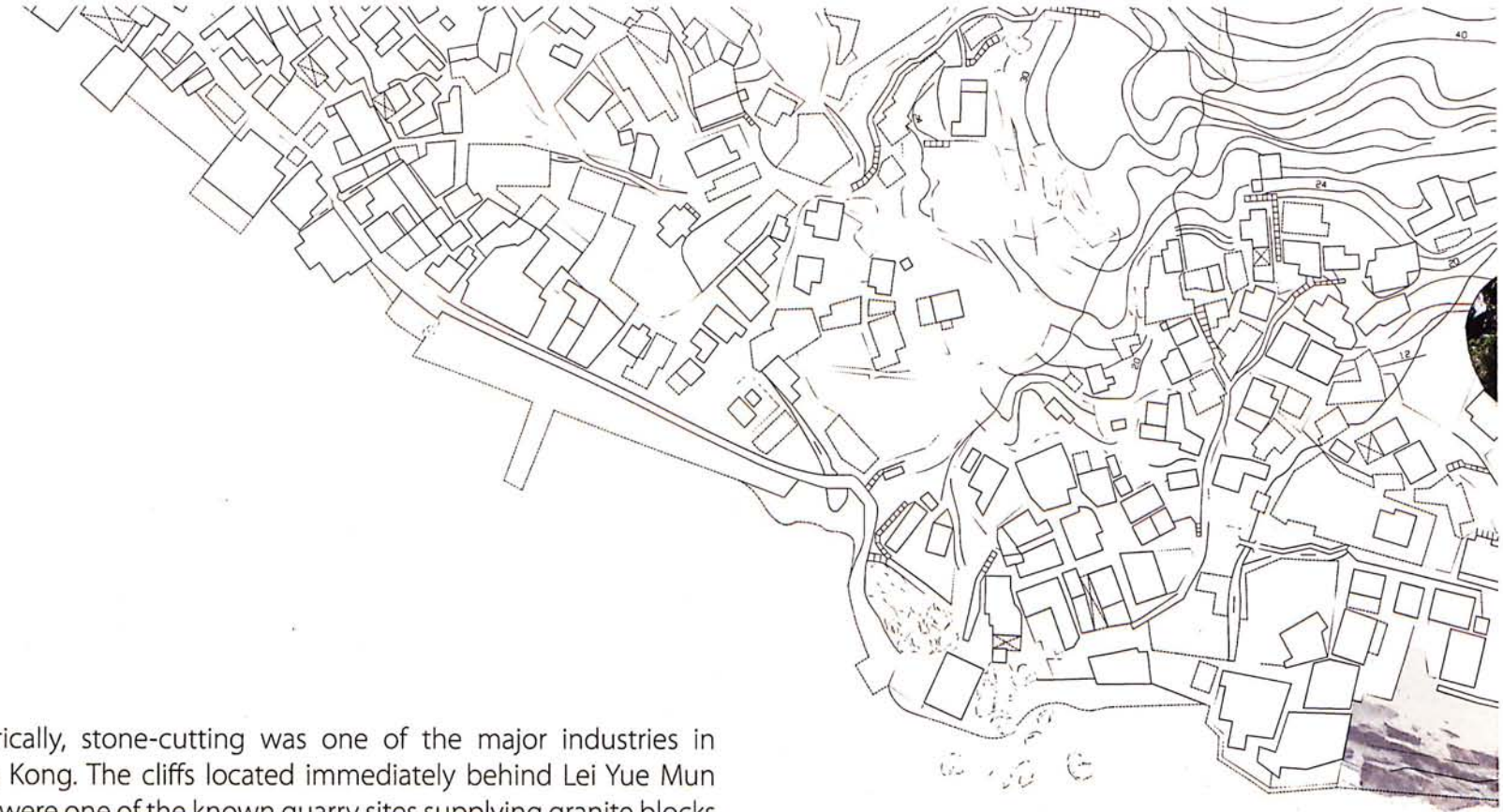


Design Development





Development of building envelopes



Historically, stone-cutting was one of the major industries in Hong Kong. The cliffs located immediately behind Lei Yue Mun Point were one of the known quarry sites supplying granite blocks for the industry. As the quarry industry in Lei Yue Mun had been abandoned by the early 1960s, the rock face has been recovered by natural weathering and vegetation.

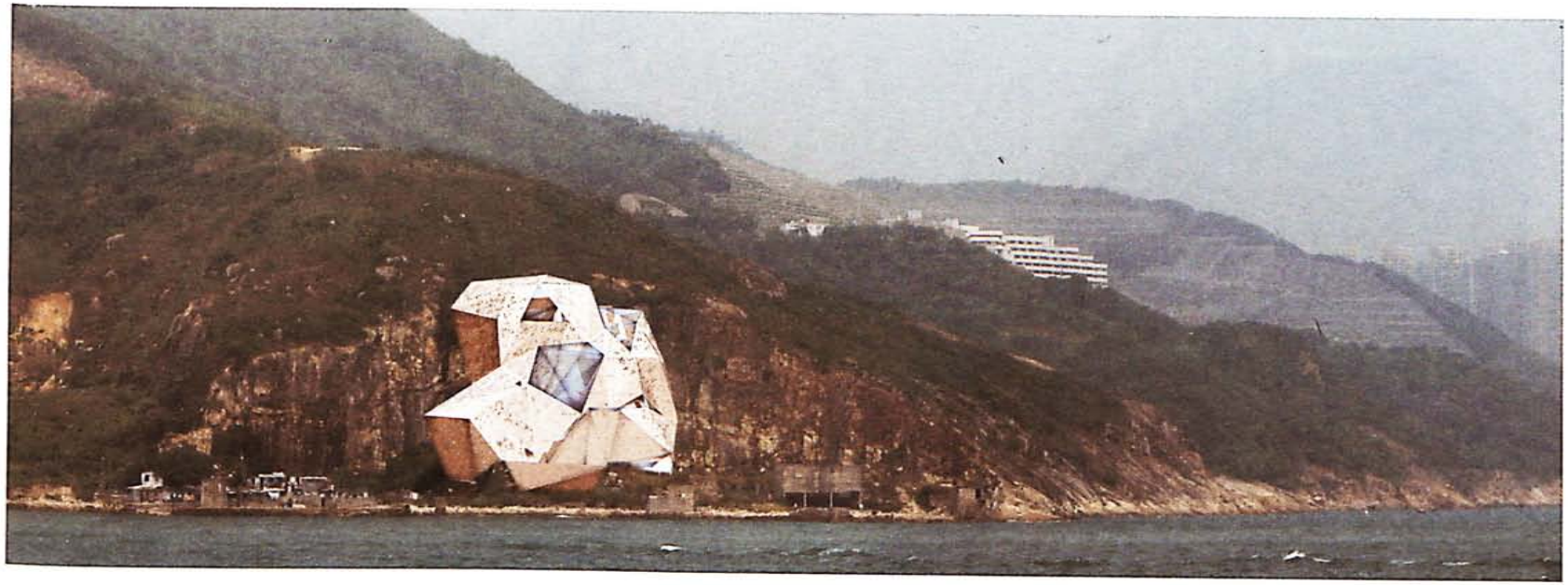
The building is located at the junction of two vertical quarry faces. The unique topography provides a potential rock surface, which creates spatial interaction with architecture.

Lei Yue Mun Point

Site - Lei Yue Mun Point

Historically, stone-cutting was one of the major industries in Hong Kong. The cliffs located immediately behind Lei Yue Mun Point were one of the known quarry sites supplying granite blocks for the industry. As the quarry industry in Lei Yue Mun had been abandoned by the early 1960s, the rock face has been recovered by natural weathering and vegetation.

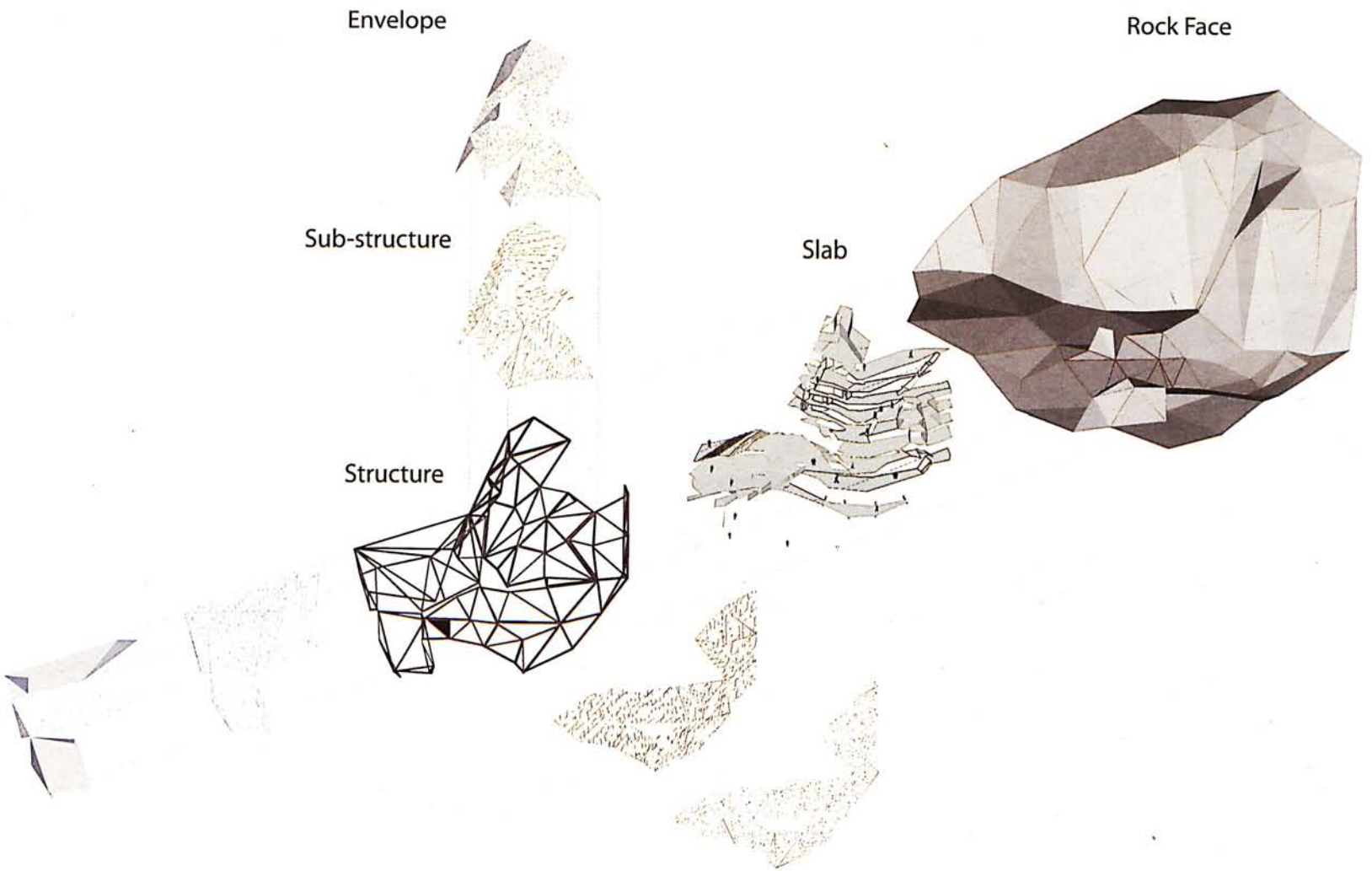
The building is located at the junction of two vertical quarry faces. The unique topography provides a potential rock surface, which creates spatial interaction with architecture.



Development of Building Form

There is a strong relationship between my architecture and the rock face. Rock surface acts as a reference to induce the form and spatial organization of the building. The building envelope acts as an extension of the rock face. The building form also defined the open spaces around the quarry site.

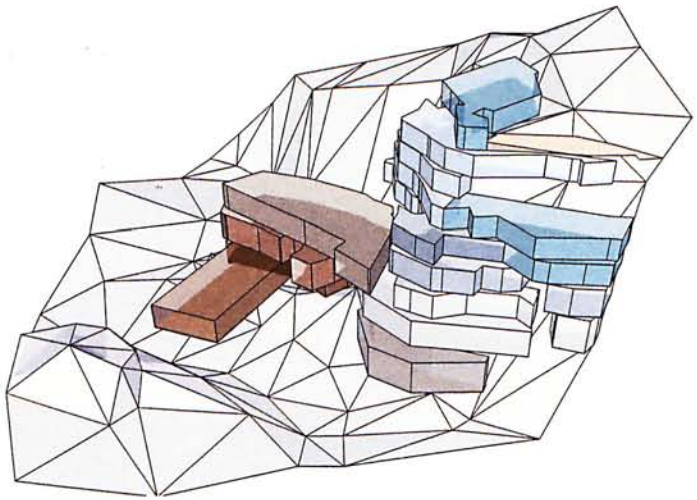
Form, Space, Structure, & Surface

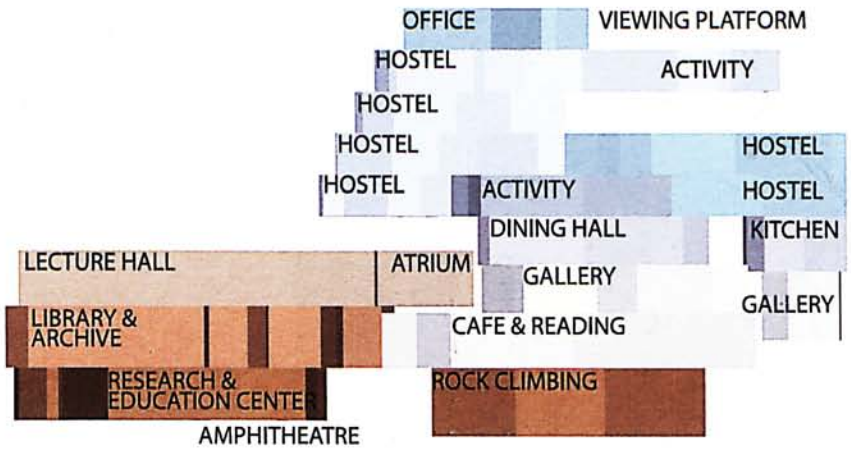


Program - Educational Youth Hostel

As Lei Yue Mun is a famous travelling place and a part of Wilson Trail Stage 3, the visitors and hikers can enjoy the recreational, educational and hostel facilities. The building also provides a public path which connects the top and bottom of the site, and at the same time, allows the public to experience the interiority of the rock.

Programmatic Organization





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9/F
▼29.00
8/F
▼26.50
7/F
▼23.50
6/F
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5/F
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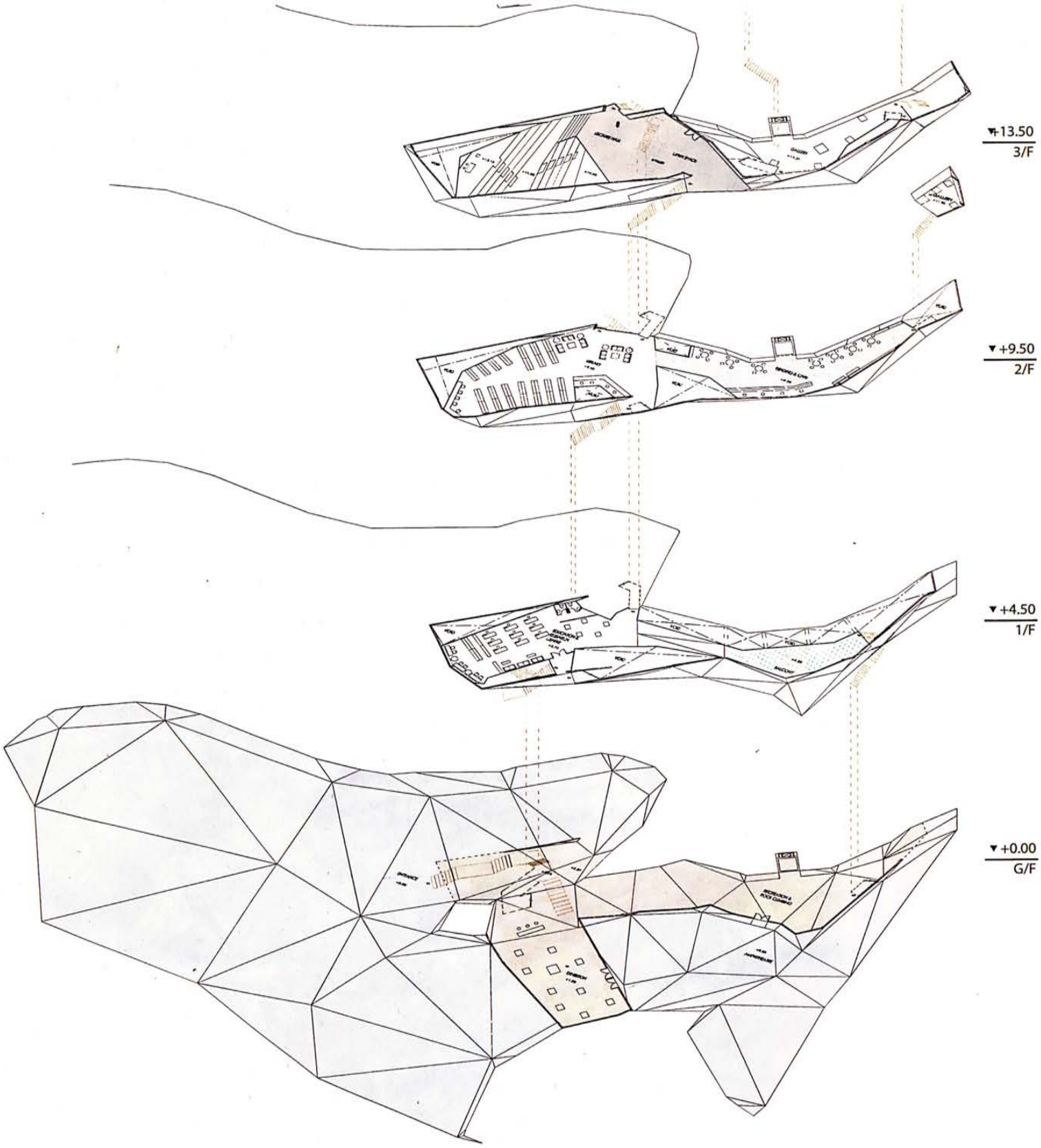
18m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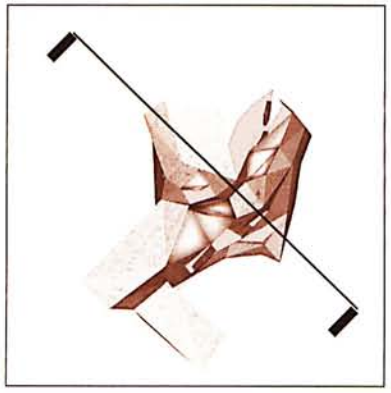
1/F
▼+0.00
G/F



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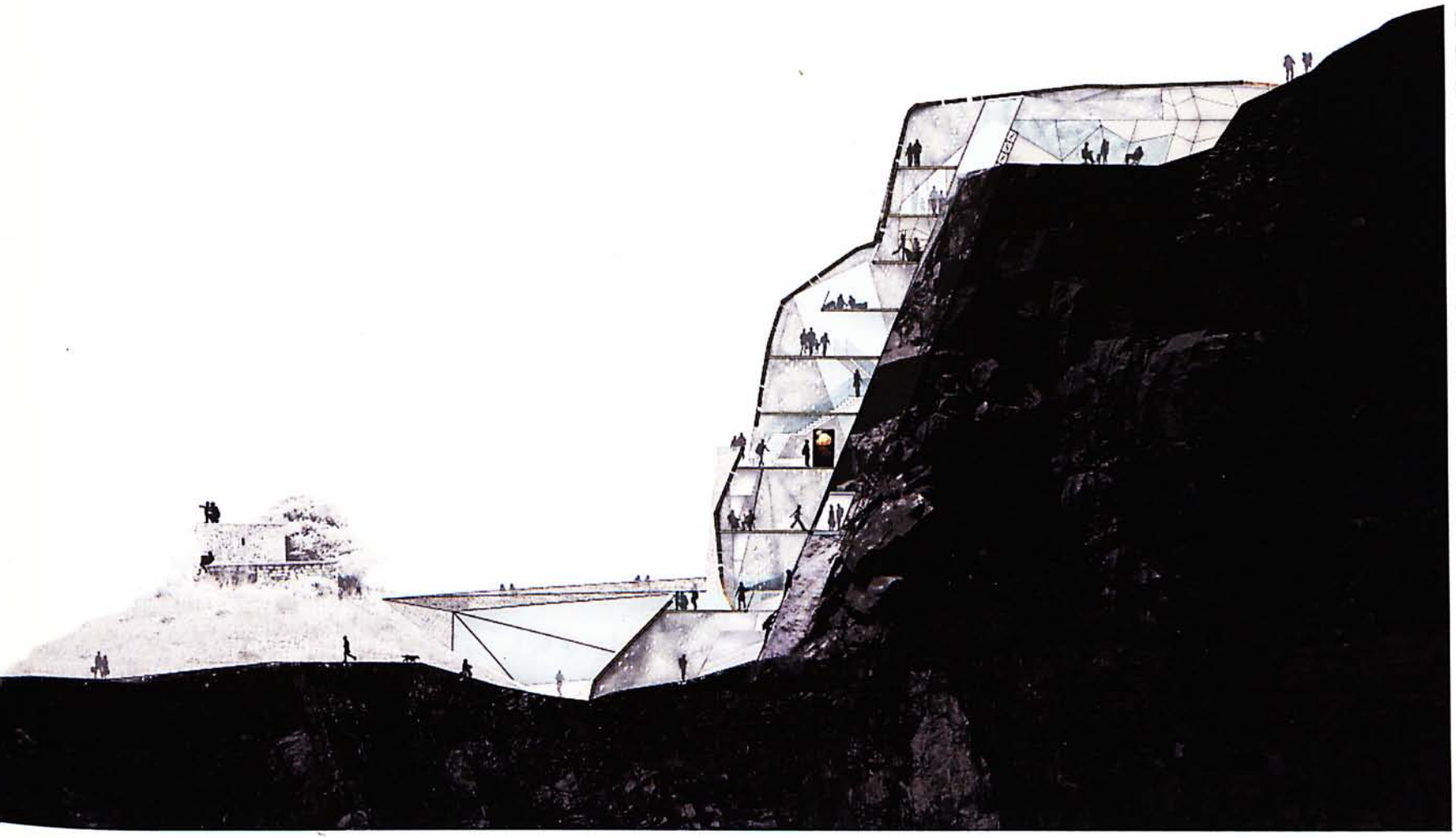

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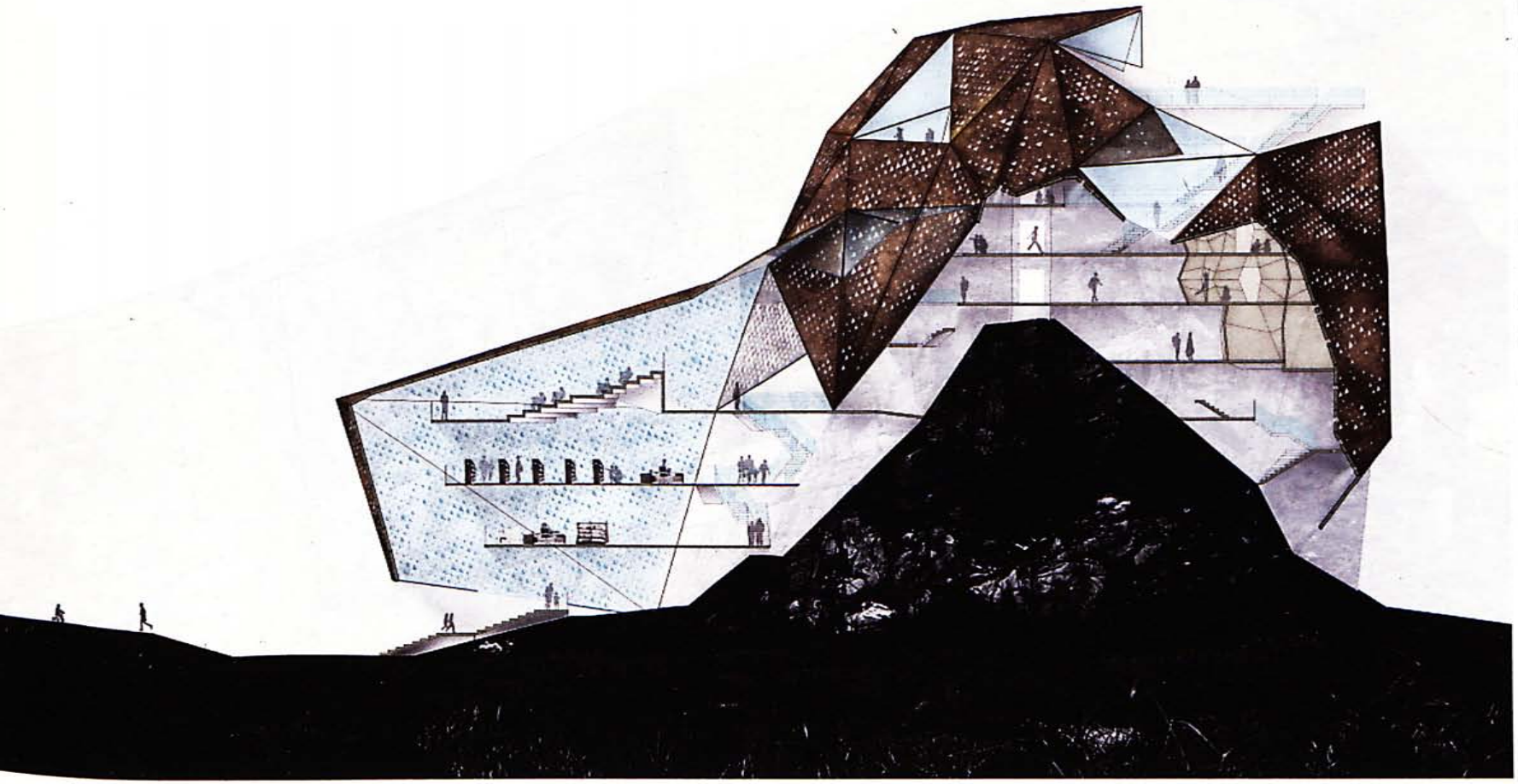

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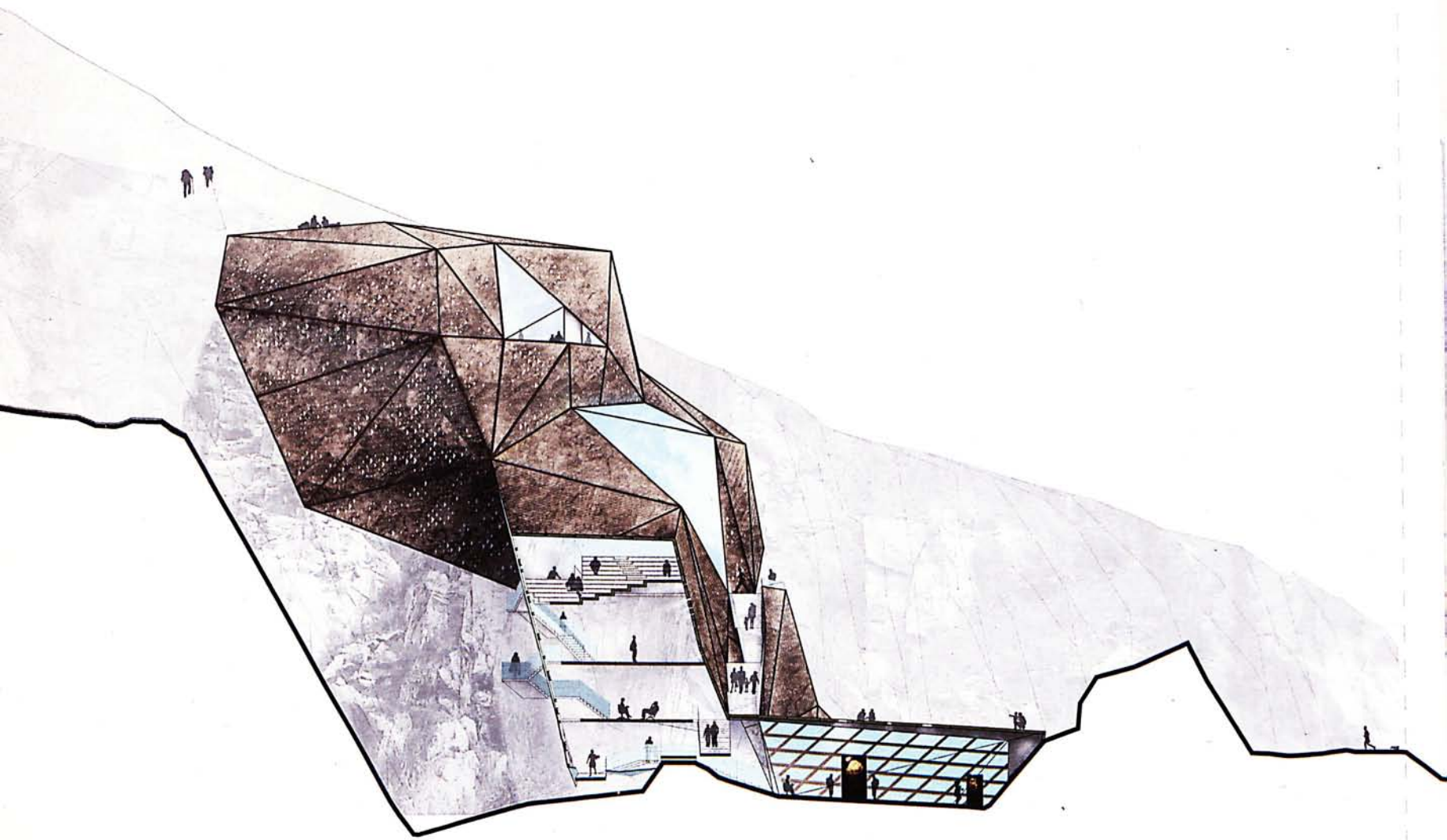

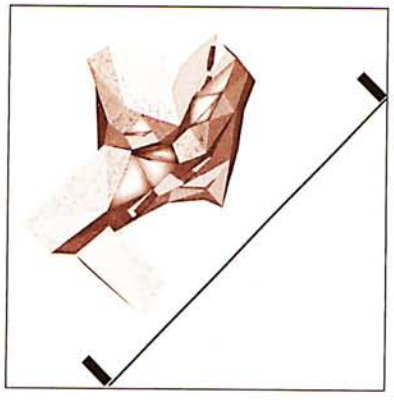

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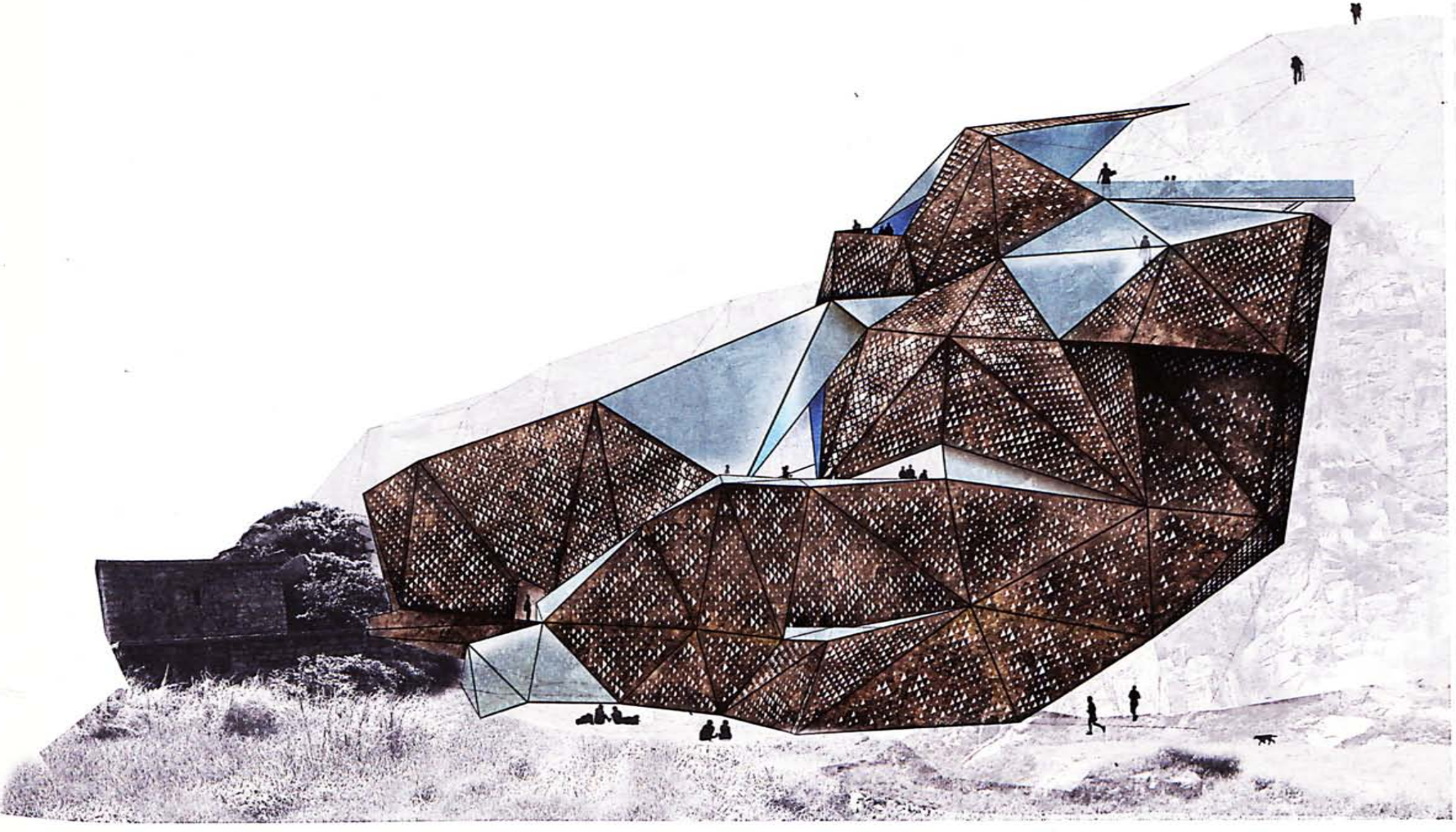
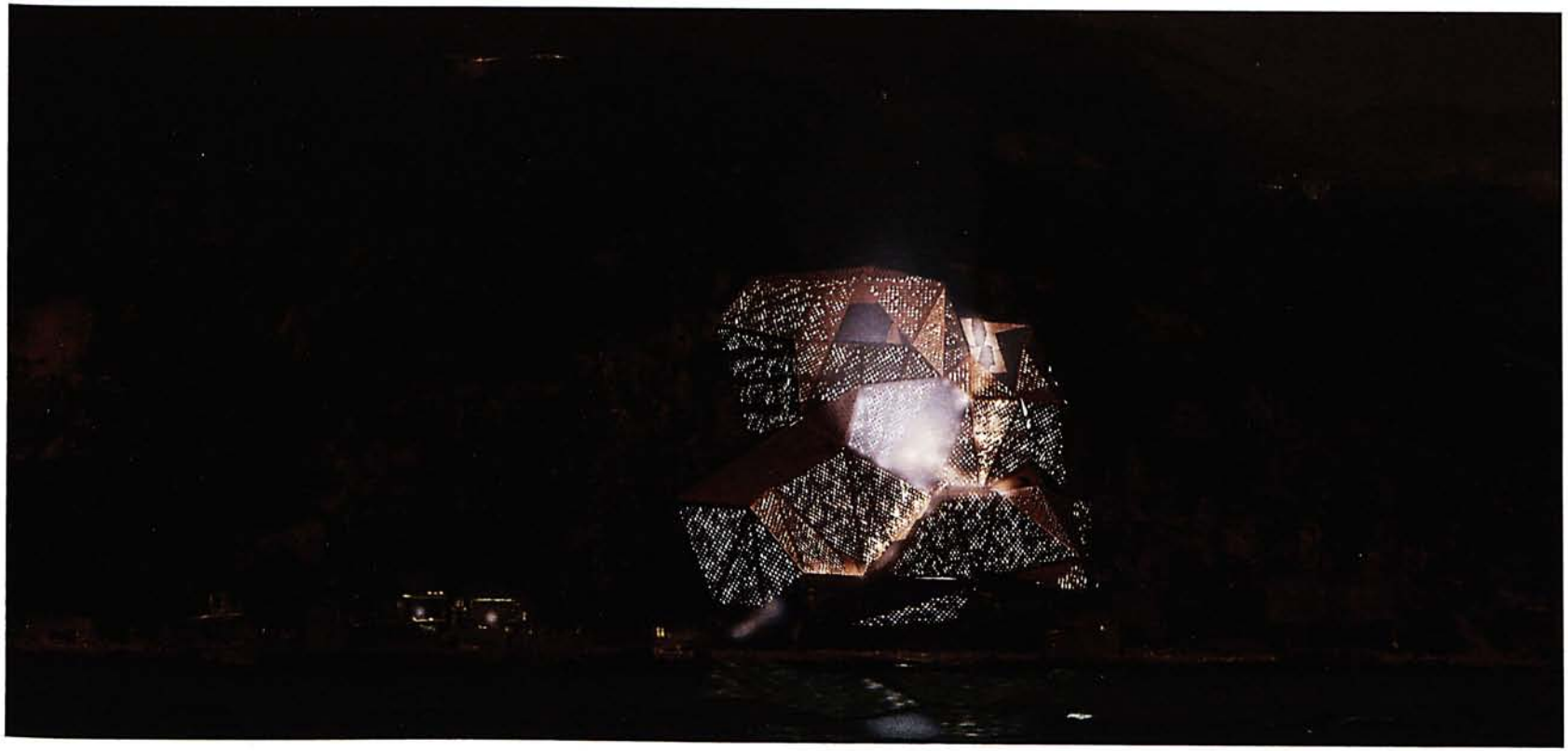
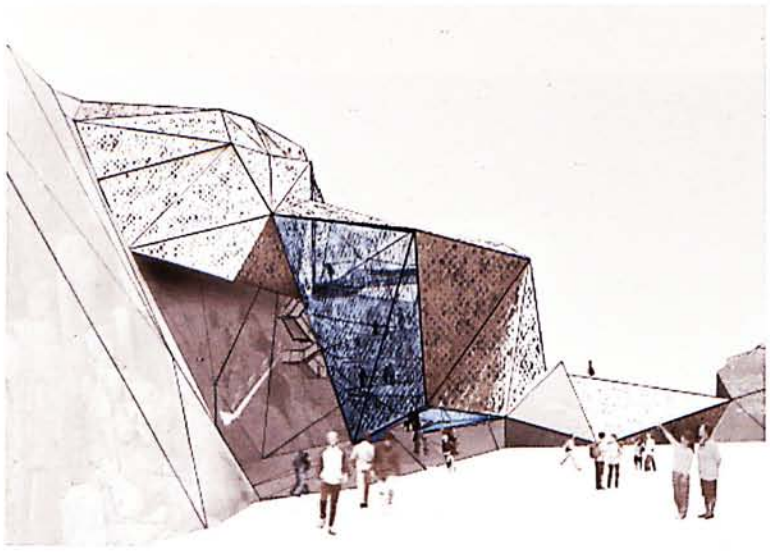
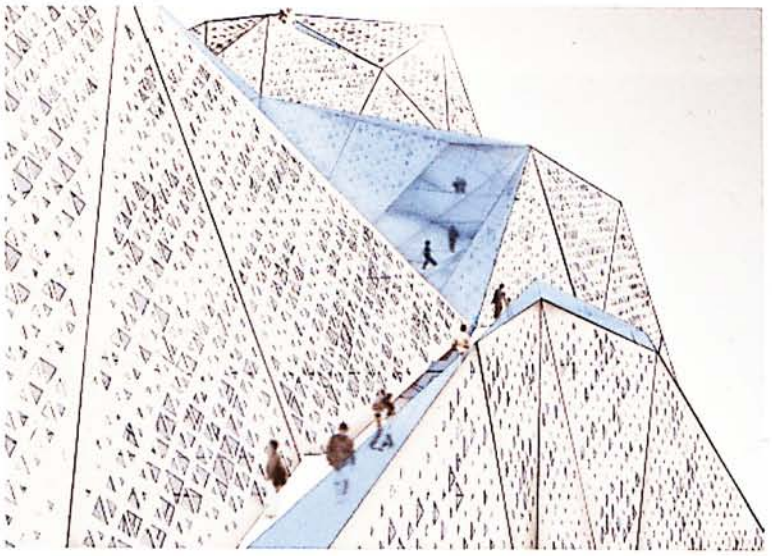


Light Up Public Path & Quarry
Night View from Victoria Harbour

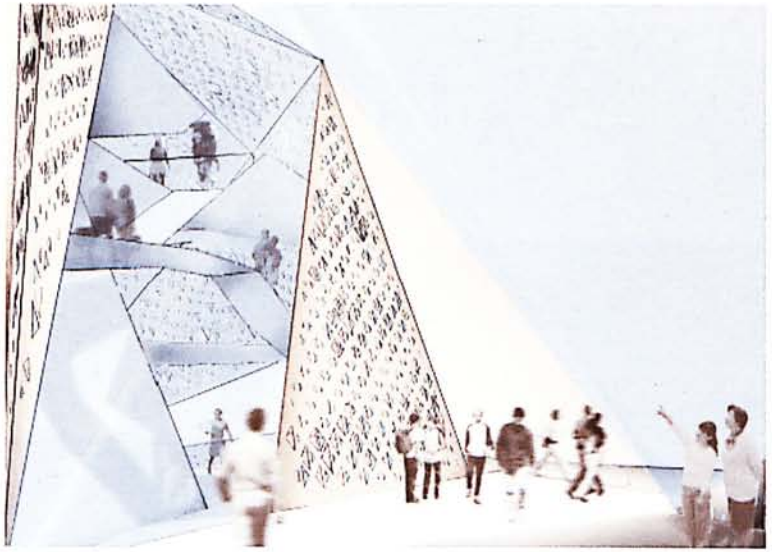




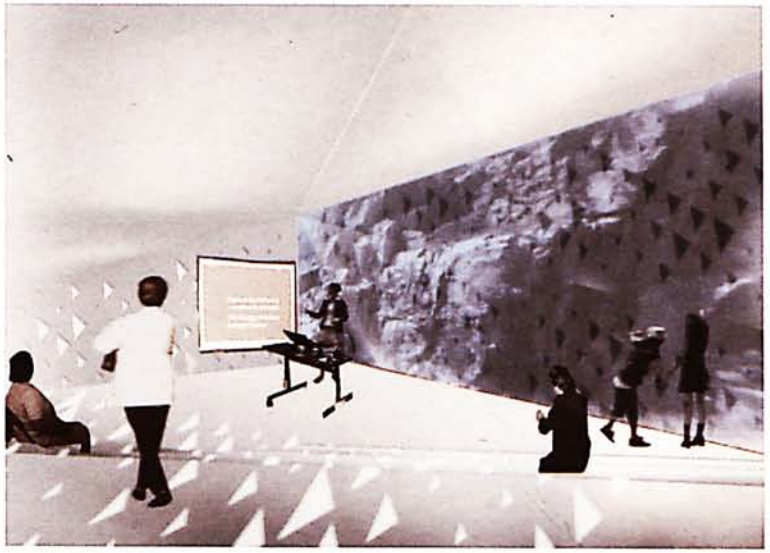
View of main entrance



View from roof garden to the atrium - visual continuity of public path

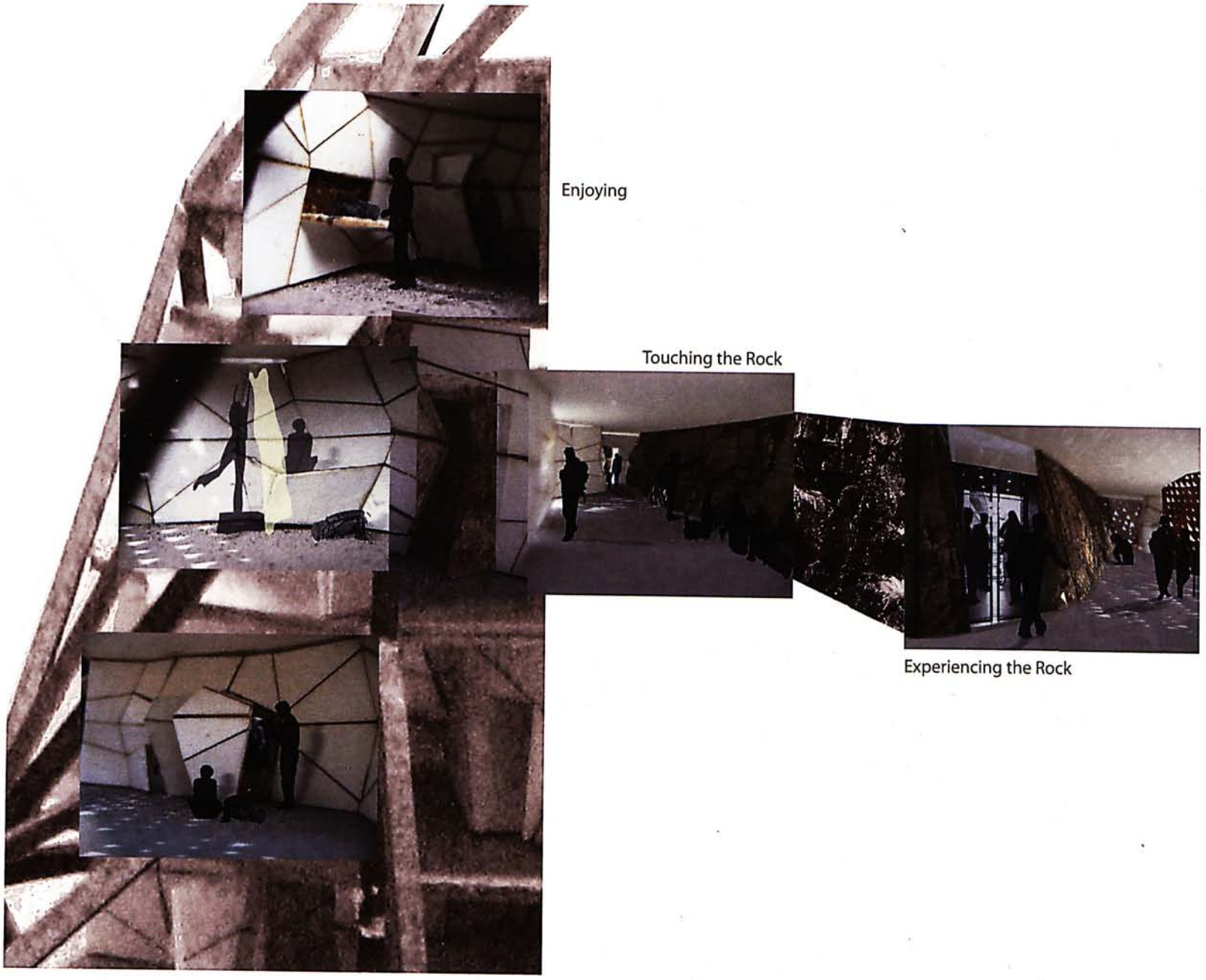


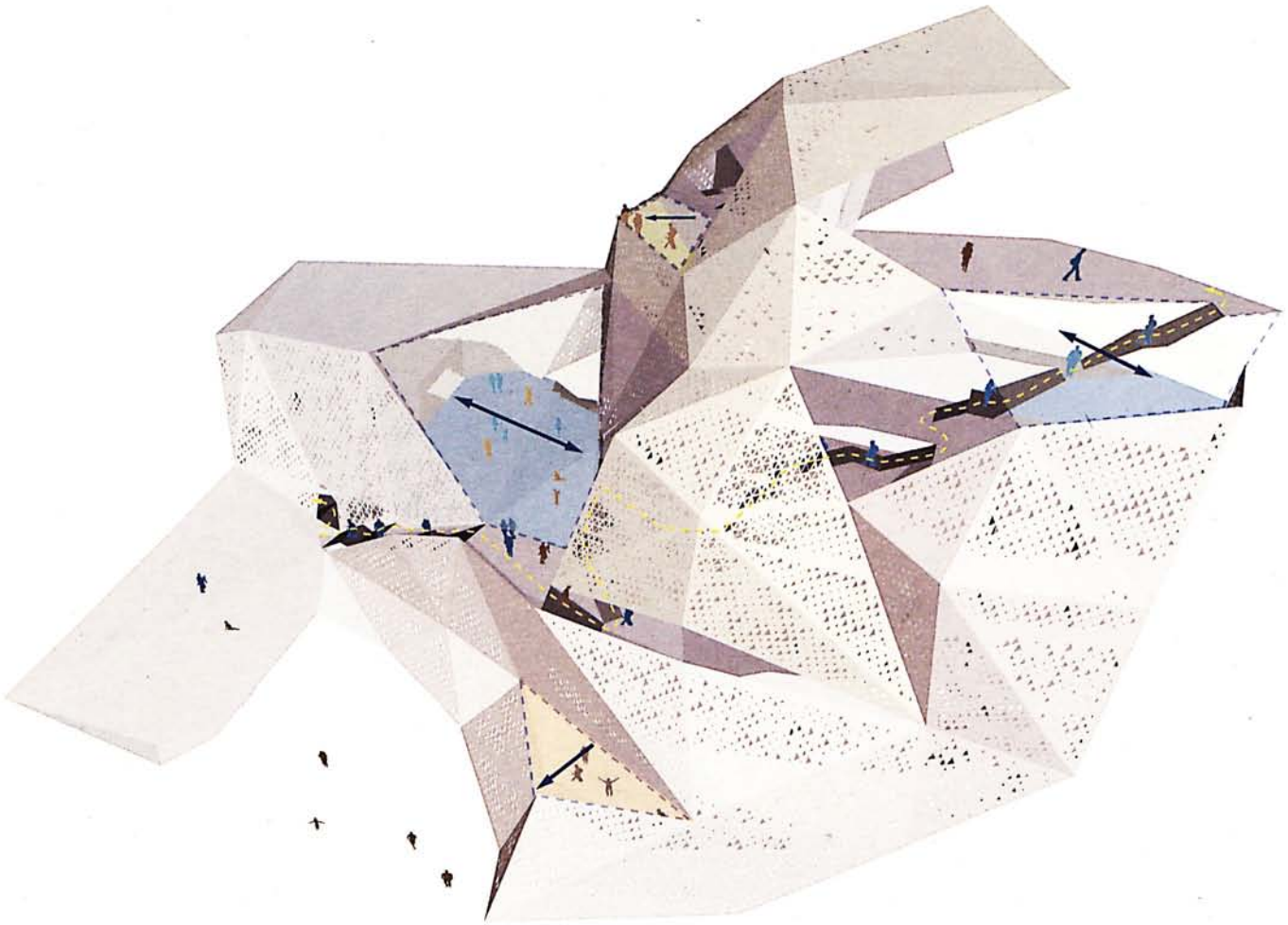
Central atrium - interaction space for public and hosteller



Internal perspective of lecture hall - rock face as a backdrop

Weaving Habitation with the Rock

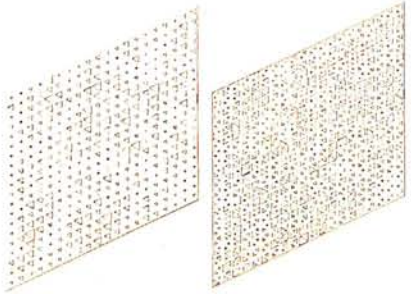


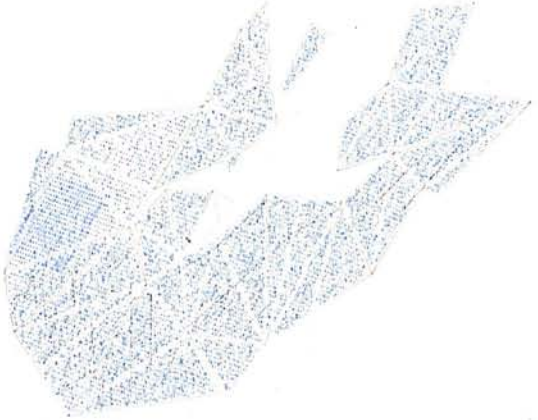


Balcony - Gap between homogeneous surface
Atrium/Public Path - Gap between heterogeneous surface

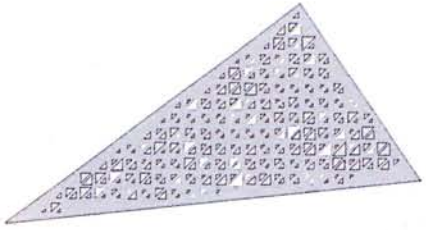
Weaving Surface

Facade Design Development

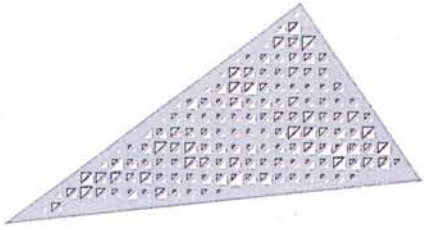




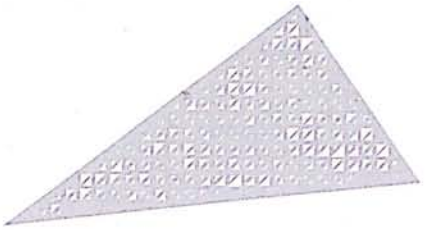
Transparency of Facade vs Space Function



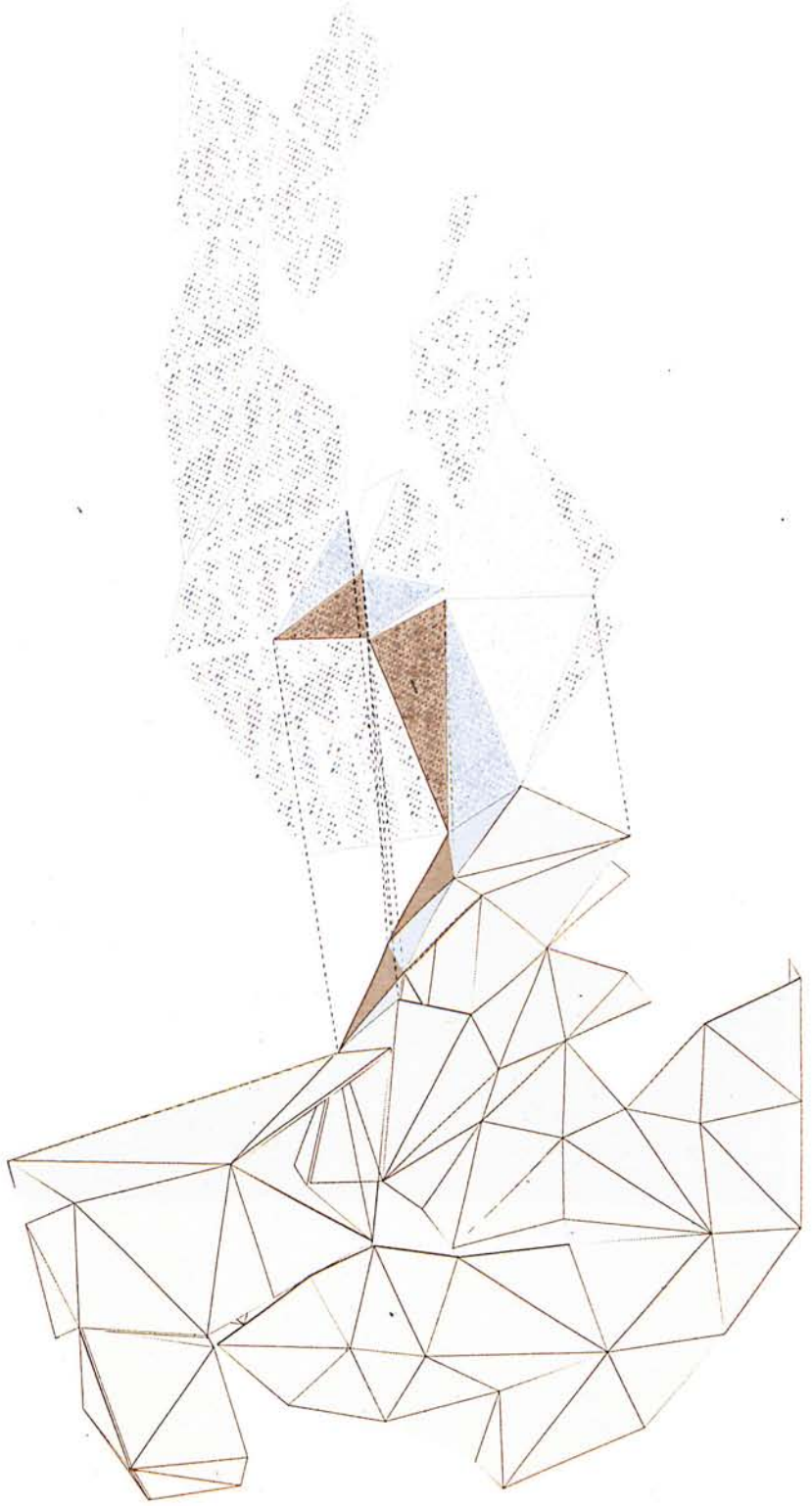
Private Space - 10%
(Hostel)



Semi Private Space - 50%
(Communal Space)



Public Path Circulation - 100%
(Space Along Public Path)



Facade detail

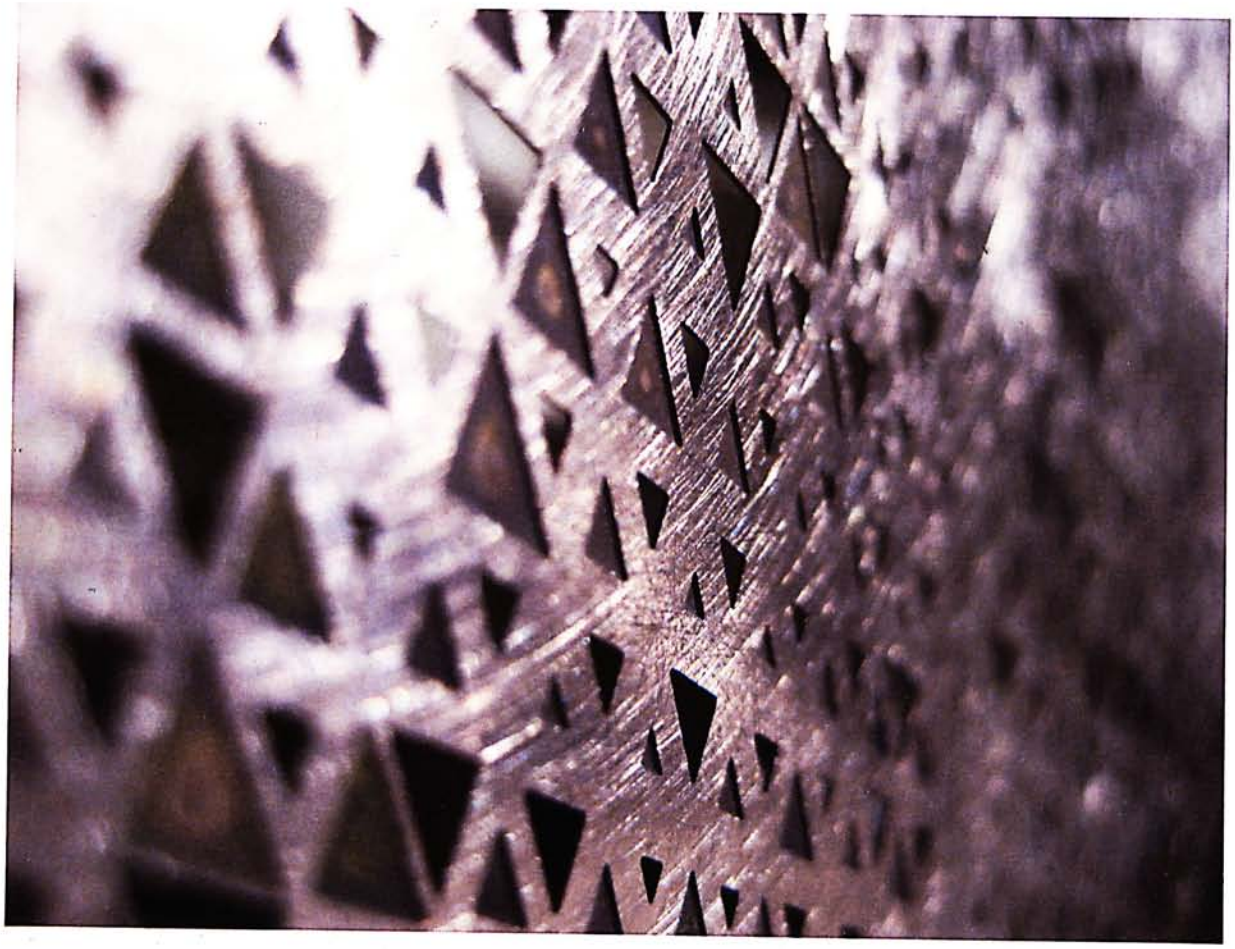
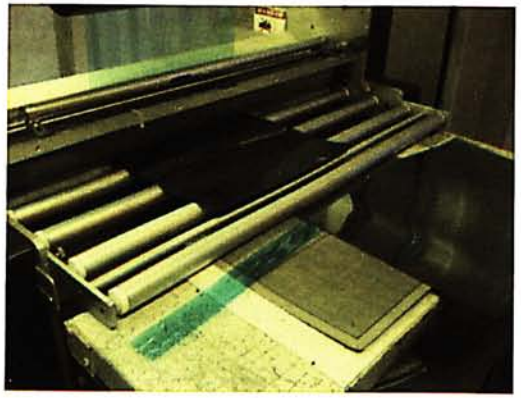
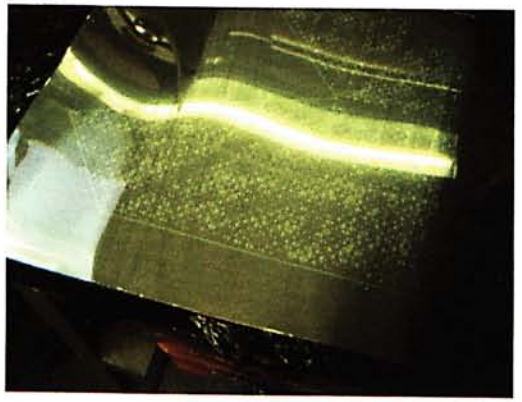
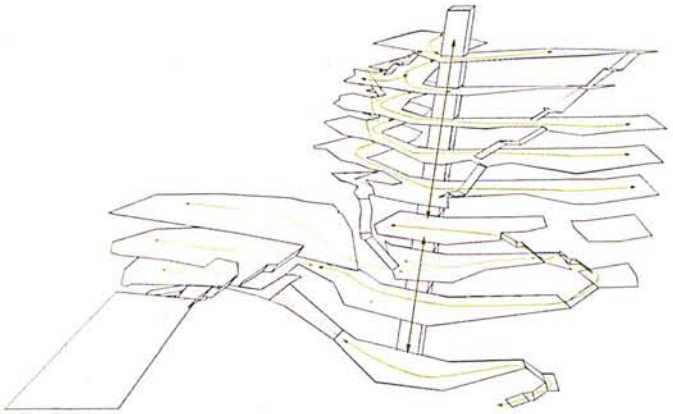


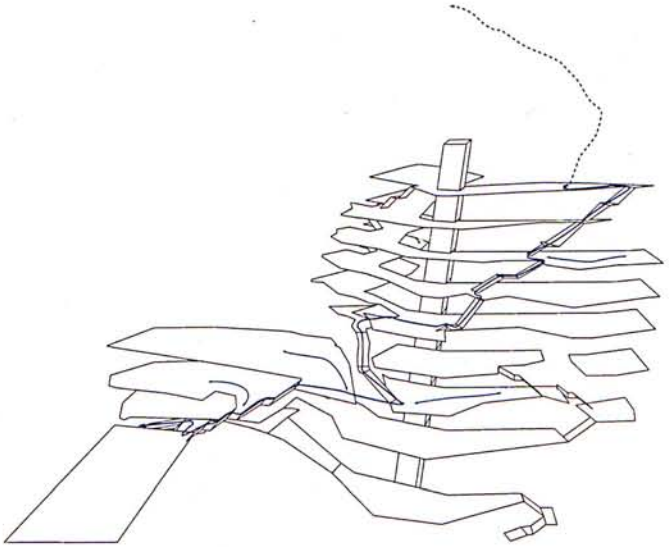
Photo Chemical Machining





Weaving Circulation Space



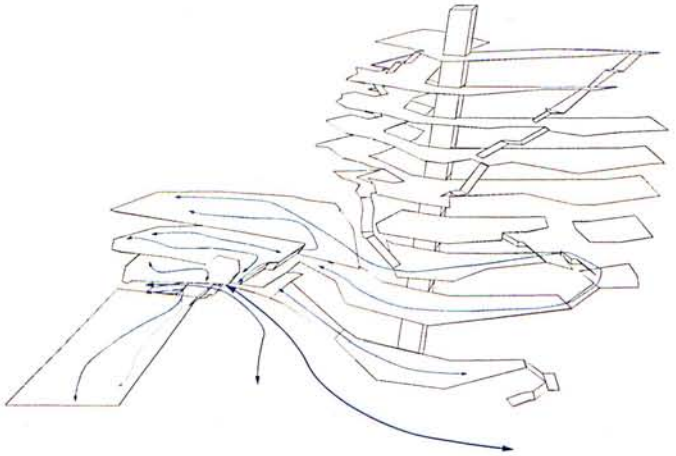


Hosteler

Hostelers stays mainly on upper floors of the building and have horizontal movement. Hostelers and hiker would have interaction in the semi private/open space along the hiking path.

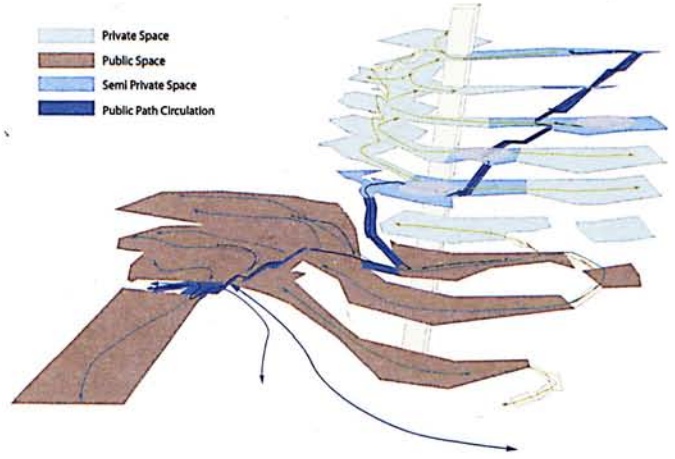
Hiker

The design provides and encourages hiking through the surface and the internal space of the building envelope. The circulation pass through public open space and semi private space of the hostel area as well.

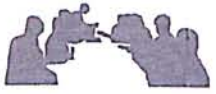


Visitor

Including Lei Yue Mun Villagers, Public to visit the exhibition, gallery, library and also attend the lecture. the circulation pattern would concentrate on the first 3 floors and be horizontal.

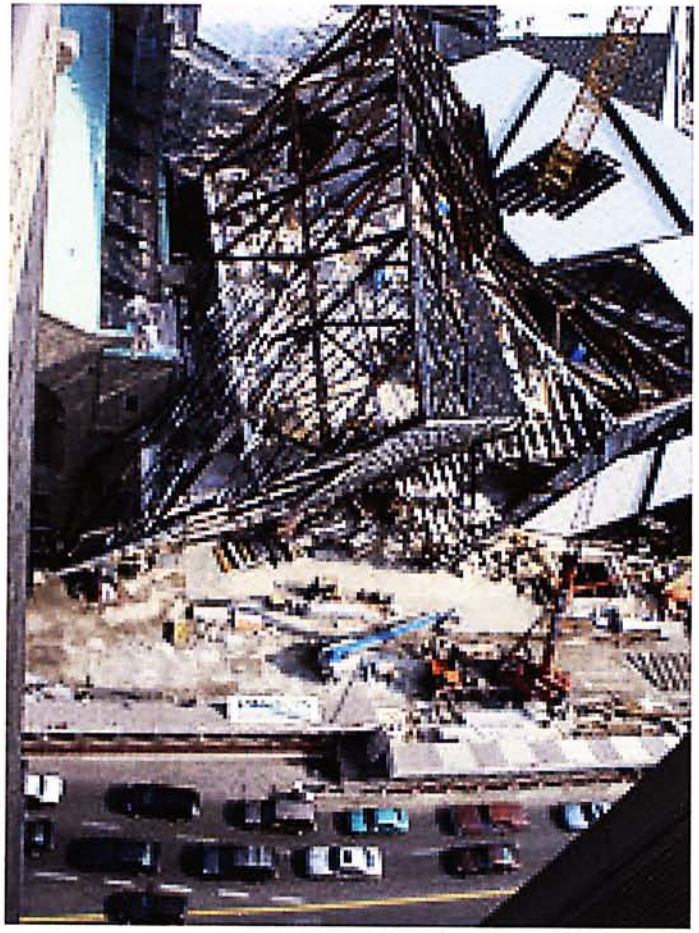


Interaction



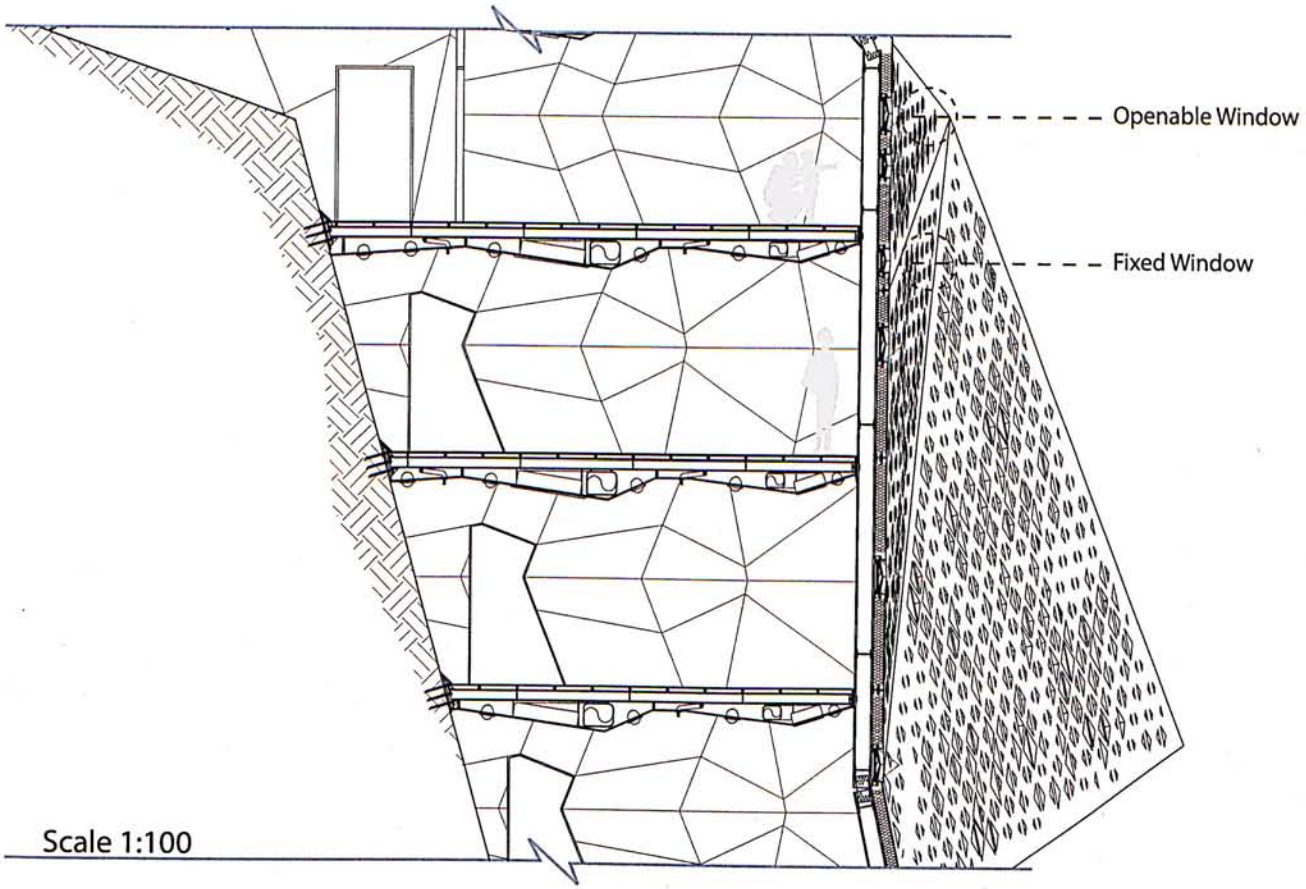
Circulation of different groups weave together through the public and semi-public space. Interaction and dialogue among different groups are expected to evolve.

Structural Studies



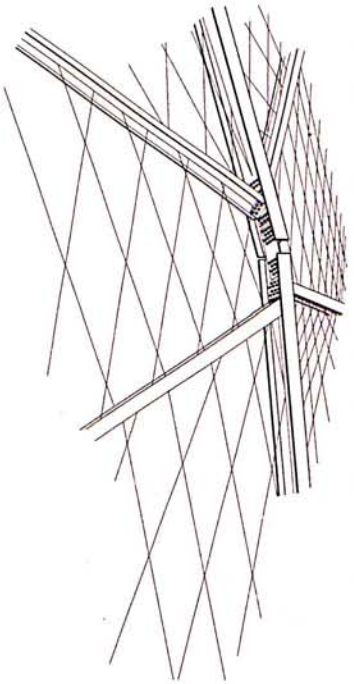
The Crystal by Daniel Libeskind

Detailed Section Through Hostel

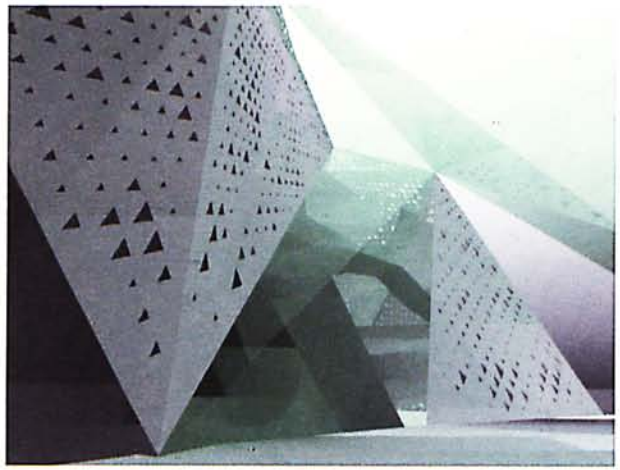


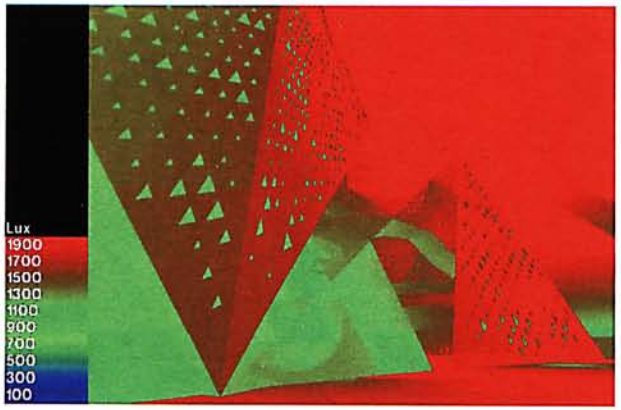
Scale 1:100

Construction Joint

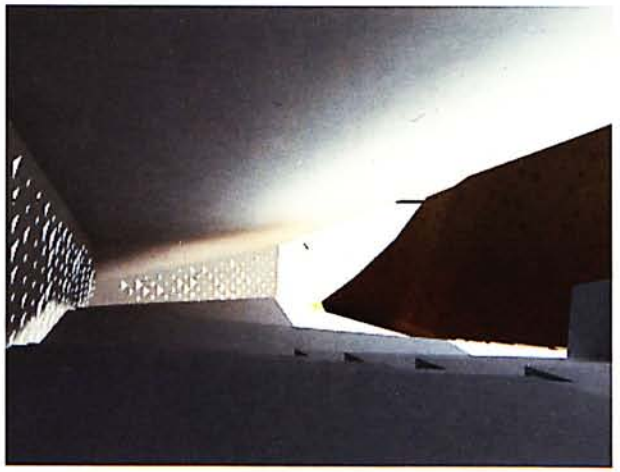


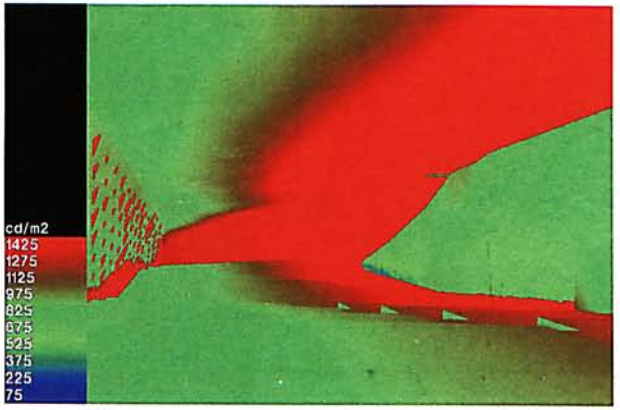
Daylight Simulation Studies



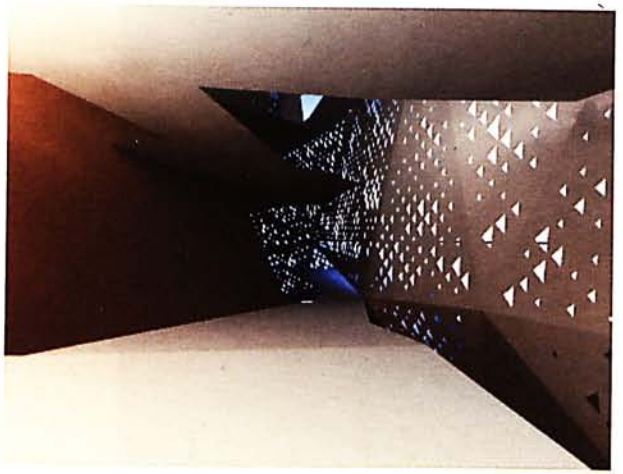


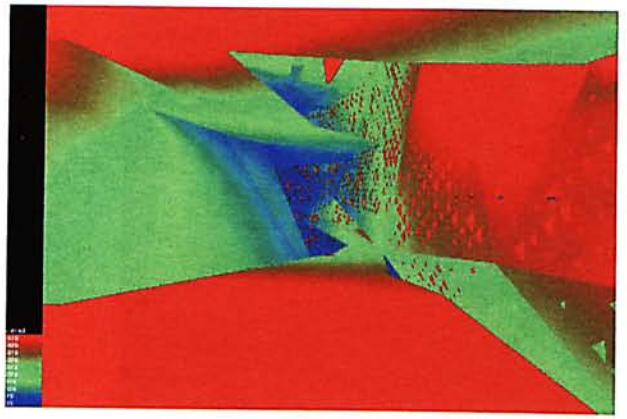
Lighting quality of Atrium





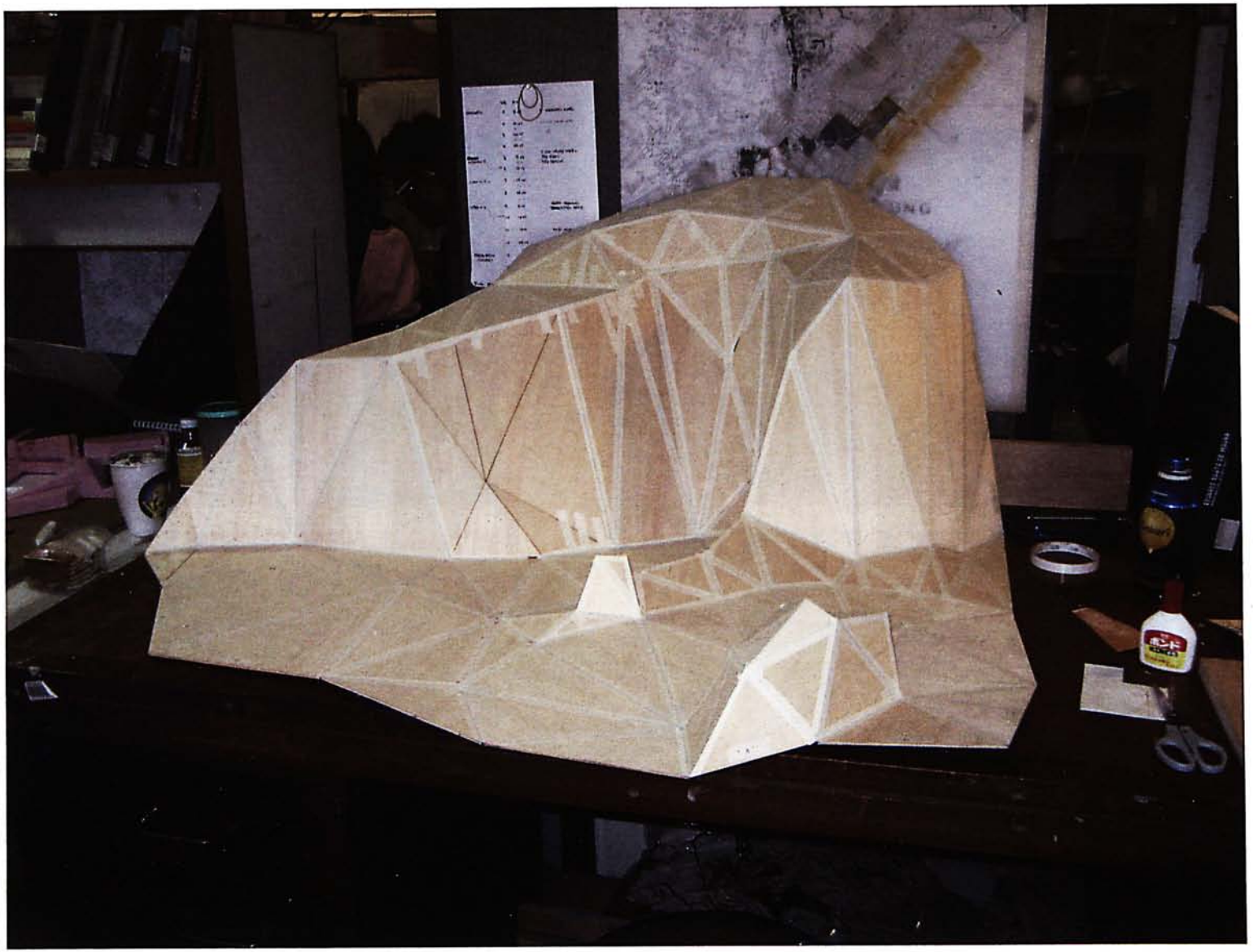
Lighting quality of Lecture hall

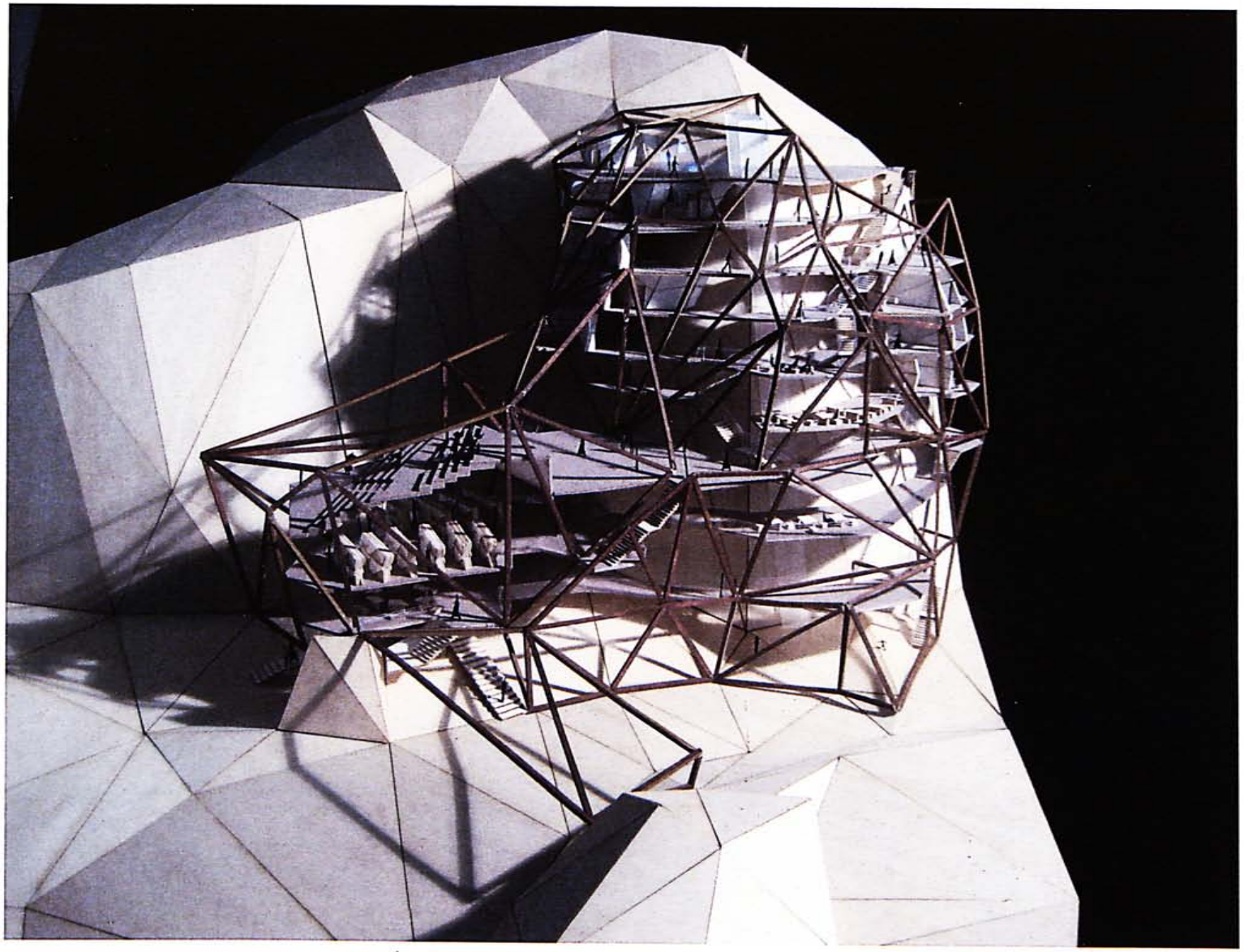


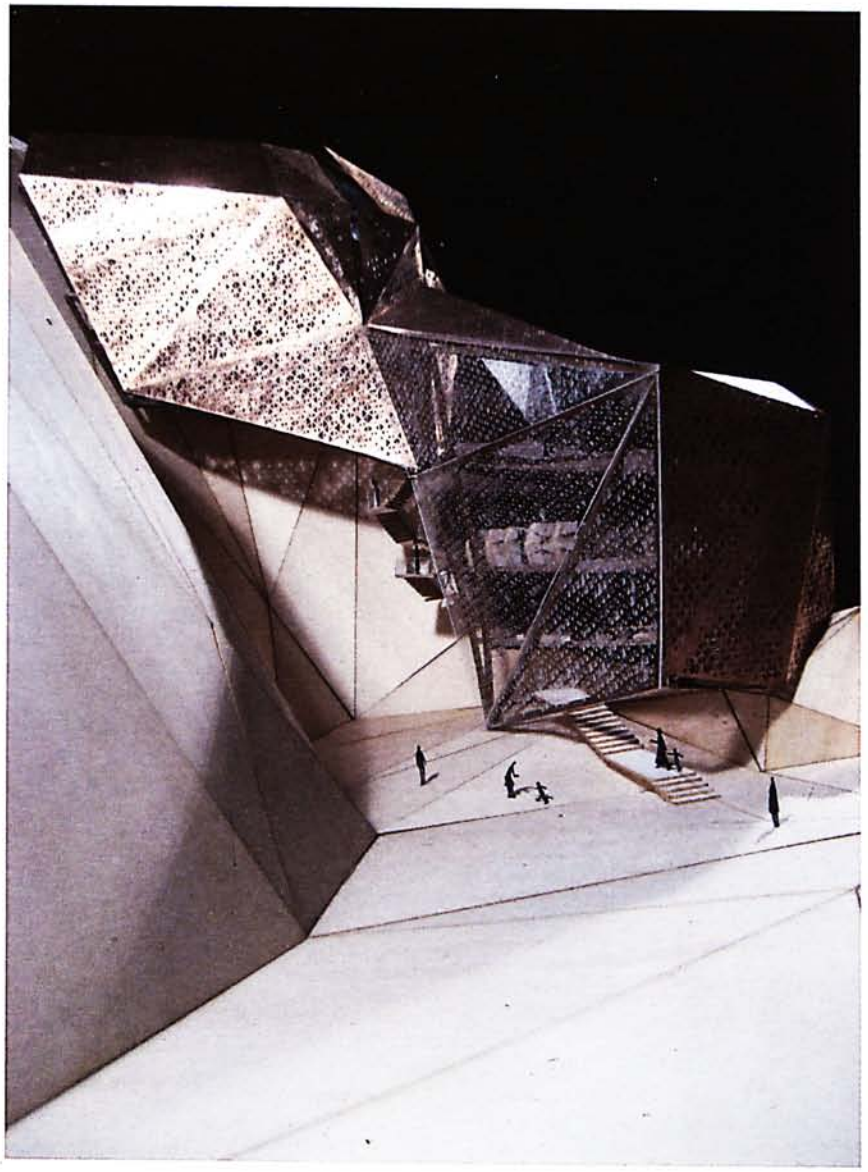


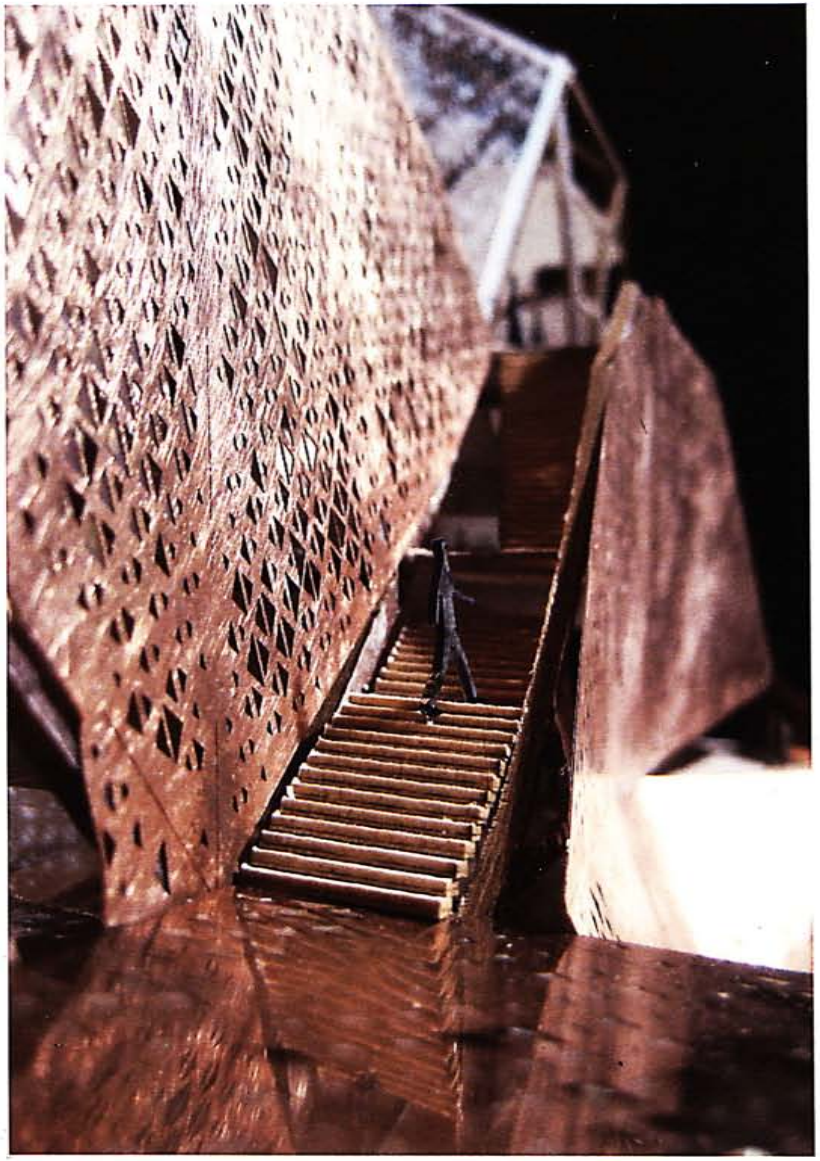
Lighting quality of public space

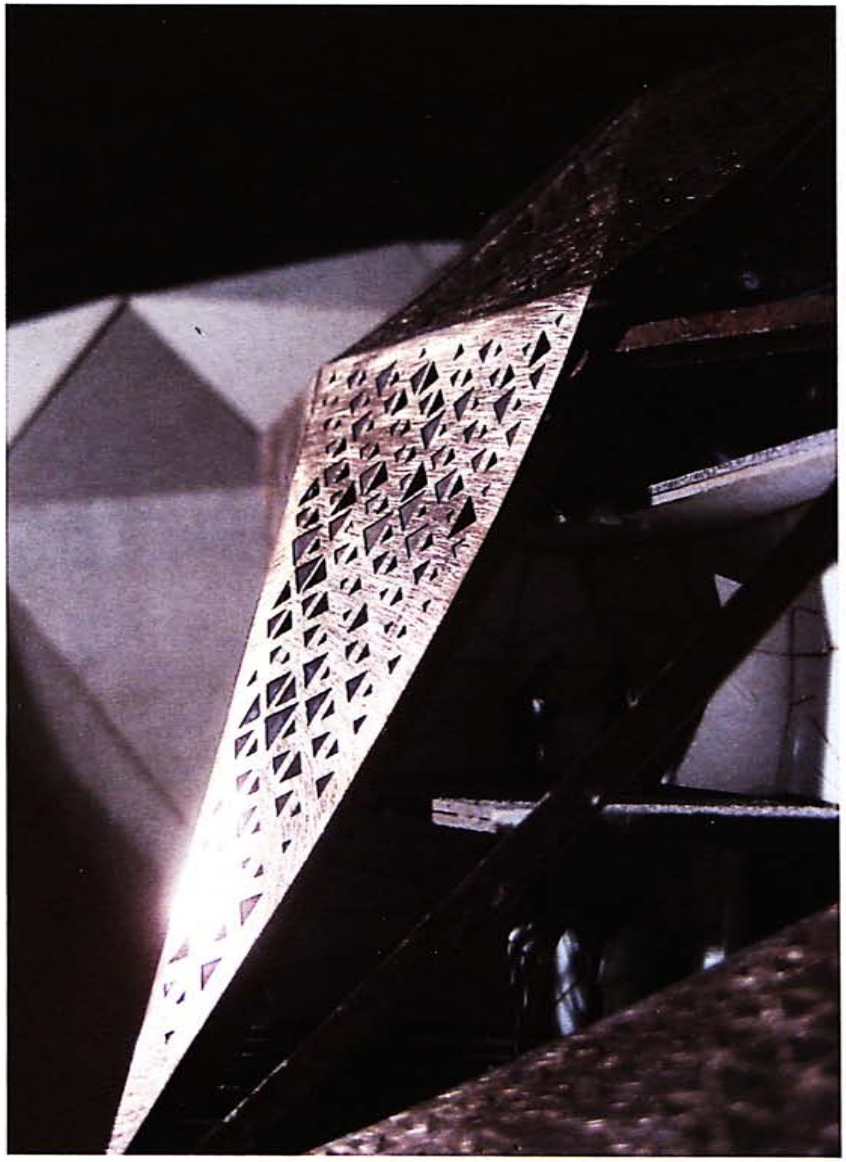
Model Photo

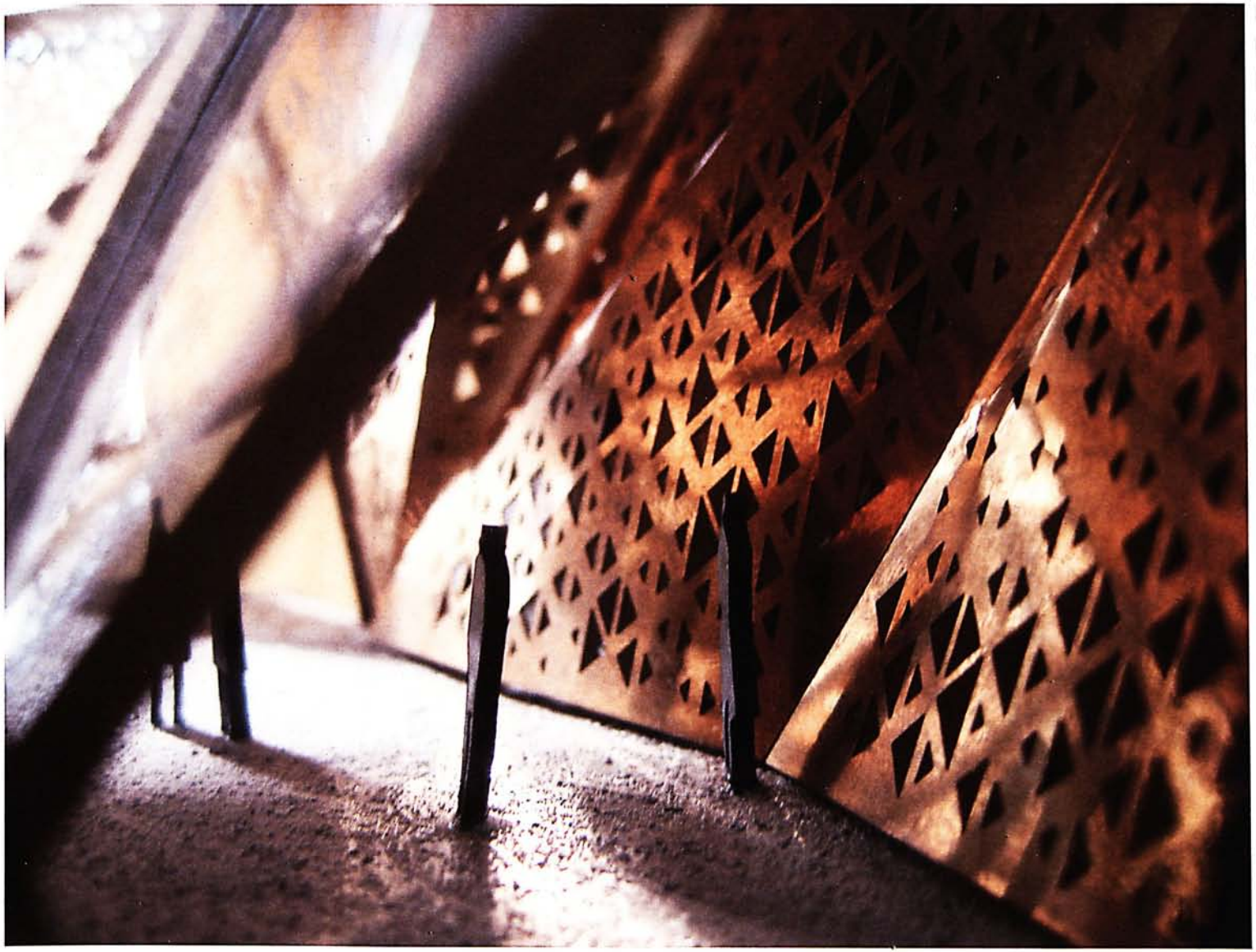












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